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THE POLLUTION CONTROL EQUIPMENT INDUSTRY IN ONTARIO

– HISTORICAL PERFORMANCE AND POTENTIAL

– POSSIBILITIES OF IMPORT SUBSTITUTION

October 1978

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1978
MOE

Ontario

Ministry of the Environment

The Honourable
Harry C. Parrott, D.D.S.,
Minister

K.H. Sharpe,
Deputy Minister

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Ontario

Ministry
of the
Environment

135 St. Clair Avenue West
Suite 100
Toronto, Ontario
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MEMORANDUM

November 17, 1978

TO: See Distribution List

FROM: A. Castel
Director
Program Planning & Evaluation Branch

RE: Report - The Pollution Control Equipment Industry in Ontario

You may be interested in the attached report on the pollution equipment manufacturing industry in Ontario, which was produced at the request of the Premier's Advisory Committee on the Economic Future.

Since the report contains recommendations for action by the Provincial Government, it is not intended for general distribution.

André Castel

cc: Mr. K. H. Sharpe
Mr. J. W. Giles
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November 17, 1978

THE POLLUTION CONTROL EQUIPMENT INDUSTRY IN ONTARIO

- HISTORICAL PERFORMANCE AND POTENTIAL
- POSSIBILITIES OF IMPORT SUBSTITUTION

OCTOBER, 1978

MINISTRY OF THE ENVIRONMENT
PROGRAM PLANNING AND EVALUATION BRANCH

R. E. Smith, Senior Analyst

DISCLAIMER

Some of the information provided in this report was gathered by means of telephone and personal conversations with Ontario manufacturers of pollution control equipment. Its accuracy cannot be confirmed.

The information was not verified by a personal examination of corporate documents.

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SUMMARY OF RECOMMENDATIONS

Page 25:

IT IS RECOMMENDED THAT THE MINISTRY OF INDUSTRY AND TOURISM ANALYSE THE TOTAL DEMAND IN ONTARIO FOR FLARES, AFTERBURNERS, AND THERMAL AND CATALYTIC INCINERATORS, WITH A VIEW TO DETERMINING IF IMPORT SUBSTITUTION OF THESE ITEMS IS FEASIBLE.

Page 46:

THAT THE GOVERNMENT REVIEW THE PRESENT PURCHASING POLICY TO DETERMINE IF IT IS ACTING IN THE LONG-TERM INTEREST OF THE CANADIAN MANUFACTURING INDUSTRY.

Page 59:

THAT AN ANALYSIS OF THE DUTY REMISSION PROGRAM BE INITIATED TO DETERMINE IF IT IS A NET BENEFIT TO THE CANADIAN ECONOMY;

IN THE MEANTIME, THAT ELIGIBILITY FOR DUTY REMISSION BE RESTRICTED TO PROVIDE CANADIAN MACHINERY AND EQUIPMENT MANUFACTURERS A BETTER OPPORTUNITY TO FILL SOME OF THE IMPORT DEMAND.

Page 64:

THAT THE MINISTRY OF THE ENVIRONMENT REVISE ITS ROLE TO FURTHER SUPPORT THE ACCEPTANCE OF NEW CANADIAN POLLUTION CONTROL EQUIPMENT AND PROCESSES FOR WATER AND WASTEWATER TREATMENT.

INTRODUCTION

BACKGROUND

In December, 1977 the Job Creation Sub-Committee of the Advisory Committee on the Economic Future requested the Ministry of the Environment to evaluate the degree of importation of pollution control equipment into Ontario. It was hoped that "import substitution" could provide a significant number of new jobs in the local equipment manufacturing sector. The general opinion at that time of Ministry staff dealing with capital projects was that substantial quantities of water and sewage treatment equipment were imported from the United States. Summary information on air pollution equipment was not available.

This report:

1. Analyzes the historical demand for pollution control equipment in Ontario and the historical degree of importation;

2. Makes projections of upcoming pollution control equipment requirements;

3. Analyzes the structure and problems of the pollution control equipment industry in Ontario;

4. Makes recommendations on methods of increasing the Canadian content of future equipment sales.

The Ministry of Industry and Tourism will be contributing to the overall study through more detailed analysis of markets, using this report and other information.

Although this report deals primarily with Ontario, the following national statistics provide a good indication of the need for this analysis:

The U.S. Department of Commerce provides regular information to the U.S. business community on export opportunities through "global market surveys". The 1976 Global Market Survey on Air and Water Purification and Pollution Control Equipment(1) gives this information:

--Comparative data, on pollution control equipment markets, 1974 and 1978-- (in millions of U.S. dollars)

Country	*Total Sales*		*Total Imports*		*Imports from US*		1978 Total Imports / 1978 Total Sales
	1974	*1978*	*1974*	*1978*	*1974*	*1978*	
Australia	*85.4*	*121*	*18.9*	*25*	*7.9*	*10.5*	21 %
Belgium	*259.0*	*644*	*125.3*	*N/A*	*10.9*	*N/A*	-
Brazil	*240.4*	*388*	*47.5*	*72*	*17.6*	*26.5*	19 %
Columbia	*5.0*	*7*	*5.0*	*7*	*1.9*	*2.8*	100 %
France	*222.7*	*262*	*32.4*	*57*	*7.5*	*12.2*	22 %
Germany	*253.1*	*376*	*29.7*	*46*	*8.7*	*14.1*	12 %
Iran	*9.9*	*21*	*9.9*	*21*	*4.9*	*10.2*	100 %
Italy	*145.8*	*387*	*35.0*	*68*	*5.0*	*11.0*	18 %
Japan	*2009.5*	*7770*	*12.8*	*61*	*7.7*	*36.7*	1 %
Mexico	*91.0*	*136*	*7.0*	*12*	*3.1*	*5.0*	9 %
Netherlands	*64.8*	*100*	*28.6*	*46*	*4.7*	*8.4*	46 %
Philippines	*18.5*	*36*	*16.3*	*33*	*5.9*	*7.3*	92 %
Singapore	*6.0*	*9*	*9.6*	*12*	*3.3*	*4.0*	133 % *
Spain	*225.9*	*468*	*118.2*	*228*	*14.4*	*28.0*	49 %
Sweden	*107.2*	*90*	*40.8*	*35*	*7.6*	*9.3*	39 %
Taiwan	*34.2*	*71*	*8.5*	*18*	*2.1*	*6.3*	25 %
United Kingdom	*177.8*	*222*	*22.9*	*29*	*7.2*	*8.3*	13 %
Venezuela	*N/A*	*N/A*	*4.5*	*N/A*	*4.2*	*N/A*	-

---

* Presumably this means that equipment is re-exported.

Since Canada is not even mentioned in this list, one might conclude that Canada is not a significant importer of pollution control equipment.

However, this report estimates:

Canadian Total Sales in 1977	-	$189.3 million
Total Imports to Canada in 1977	-	$ 71.8 "
Percentage of Imports in 1977	-	38 %

(Nearly all of the Imports came from the U.S.)

Obviously, Canada is a significant importer of U.S. equipment and in fact provides the largest export market in the world for U.S. equipment. It is not clear why Canada is excluded from the "global survey".

STRUCTURE OF THE REPORT

. The following two chapters analyze total equipment demands and imports for air pollution control equipment and water pollution control equipment. Where it appears that there may be opportunities for furthering the Canadian content of specific items of equipment, recommendations are given.

. There is no analysis of special purpose solid waste management equipment. Overall expenditures in this area are not large, and a brief review of equipment acquisitions in the private sector indicated that the majority are bulk-lift systems made in Ontario. The impact on equipment demands if there is a significant movement towards resource recovery is not explored.

. The third chapter reviews the structure and problems of the pollution control equipment industry. Additional recommendations are made for government action where there appears to be the possibility of some measurable improvement in employment or the viability of the industry.

. Most of the detailed tabular data included is given in the coloured Appendices at the end of the report to make the report itself more readable.

A NOTE OF CAUTION

There is a natural desire to use expenditures of the type developed here to judge the "performance" of industry in meeting its pollution control requirements. This is an error. Most of the expenditures in this report are related to the purchase of pollution control equipment only, and may bear little resemblance to overall pollution control expenditures.

Moreover, expenditures do not indicate whether a pollution problem has been solved. Data concerning reductions in emissions or pollution damages are needed to make this conclusion.

CHAPTER I

AIR POLLUTION EQUIPMENT

FRAMEWORK FOR ANALYSIS

The analysis in this chaper places the major industrial users of air pollution equipment into one of five sectors; correspondence of these five sectors with the standard industrial classification system in Canada (2) is as shown:

Sector	S.I.C. Inclusions
Mining and Metal Processing	Division 4 (Mines, Quarries and Oil Wells) Major Group* 12 (Primary Metal Industries)
Chemical	Major Group 18 (Petroleum and Coal Products Industries) Major Group 19 (Chemical and Chemical Products Industries)
Food Processing	Major Group 1 (Food and Beverage Industries) Major Group 2 (Tobacco Products Industries) Division 7 Major Group 1 (Storage) Industry No. 524 (Grain Elevators)
Pulp and Paper	Major Group 10 (Paper and Allied Industries)
Miscellaneous	All other Major Groups in Division 5

Division 4 and Major Group 12 were combined into one sector because of difficulties in separating the expenditures and equipment of the larger, integrated smelters between their mining and metal processing operations.

The only S.I.C. groups of importance in the Miscellaneous Sector were Major Group 8 (Wood Industries), Major Group 13 (Metal Fabricating Industries), Major Group 15 (Transportation Equipment Industries), and Major Group 17 (Non-Metallic Mineral Products Industries).

---

* *All Major Groups not identified by Division are within Division 5 (Manufacturing Industries).*

The air pollution equipment requirements of other areas of economic activity are not included. Thus, for instance, any equipment required on storage tanks of gasoline service stations is not recorded, nor are items such as grease filters at fast food take-out restaurants. All pollution equipment requirements of Ontario Hydro have also been excluded. Only the mining and manufacturing industries are considered.

EQUIPMENT TO REMOVE PARTICULATES AND CONTROL GASEOUS EMISSIONS

This section examines the major characteristics of the various types of air pollution equipment used in Ontario. For technical detail beyond this descriptive material, see Parker (3).

There are four common types of equipment used in "dust removal". The selection of the most appropriate equipment type depends on:

- the size of the particulate,
- the degree of removal required,
- temperature and flow rate of the gas stream.

1. Cyclones (or Mechanical Collectors)

Gravitational and centrifugal forces are used to separate dry particles from a gas stream. The efficiency is highest (up to 90%) for large particles (over 5μ) and falls off rapidly with decreasing particle size. Cyclones are often used as pre-cleaners to other devices, and are common in product recovery applications.

2. Baghouses

A gas stream passes through fabric filters (filter bags) and the particulate matter is trapped. The bags are periodically cleaned by mechanical shaking or by reverse pulses of air. Efficiency of 99% can be obtained with particles of size 0.005μ.

Bag fabrics have recently undergone substantial technical development, expanding the potential applications of baghouses significantly. There are now fabrics which can be used in gas streams above 600° F,

fabrics which can be used to absorb odours, and fabrics which do not disintegrate in highly abrasive atmospheres.

3. Scrubbers

Particulates are removed by the injection of dusty incoming gases into a water wash. Chemicals can be added to the spray system to remove gases. Efficiencies to 99.5% can be attained with a range of particle sizes down to 0.01μ . There are many different designs, including atomizing scrubbers, wet centrifugal collectors, spray chambers, and packed towers. These devices obviously may cause water pollution problems.

*(Mist eliminators, which may be considered as a sub-category of scrubbers, use a fibre element to collect fine particles.)

4. Electrostatic Precipitators

Precipitators are essentially large boxes with two sets of electrodes. The gas stream flows through the box and deposits charged particulates on collecting electrodes. Precipitators can operate at efficiencies up to 99.9% on liquid or solid particles down to 0.005μ .

In addition to the potential application of wet scrubbers mentioned above, there are three types of equipment used to control gaseous emissions. The use of any of these is not yet widespread in Ontario.

1. Gas Adsorbers

A solid media (activated charcoal, clay, etc.) acts like a molecular sieve to remove noxious gases. The adsorbing media may be regenerated by physical or chemical processing, or may be discarded.

2. Gas Absorbers

Liquids are used to remove soluble or reactive gas contaminants by chemical reaction.

---

* *Mists are defined as liquid particles of diameter* $< 10\mu$.

3. Fume Incinerators (Thermal and Catalytic)

The combustible gases are oxidized, usually in a self-sustaining reaction. Catalytic systems oxidize the gases at low temperatures with the help of catalysts. There is a trend to using fume incinerators in combination with gas adsorption, to concentrate the gas flow and increase the contaminant content for more efficient combustion.

EXAMPLES OF COMMON AIR EMISSIONS AND THEIR CONTROL EQUIPMENT APPLICATIONS BY SECTOR

1. Mining and Metal Processing Sector

Coking ovens emit particulates, hydrogen sulfide, sulfur oxides and hydrocarbons during charging operations and hot coke quenching. Particulates are also generated in the coal-handling stages. Controls are achieved through proper enclosures and process modifications.

Blast furnaces produce large particulate emissions and carbon monoxide in the combustion gases. In order to reuse the gas, it is customarily cleaned of particulates in a cyclone then passed through a wet scrubber and possibly a precipitator.

Gray iron foundries emit particulates, oil vapors and carbon monoxide. Most small foundries are of the cupola type and scrubbers are the most common pollution control device. Carbon monoxide emissions can be controlled by afterburners.

Non-ferrous smelters produce particulates and sulfur dioxide. Baghouses are used for material recovery and air pollution control.

2. Chemical Sector

Plastics manufacturing emits organic solvents and volatile liquids. Controls are usually through vapor recovery systems.

Synthetic fiber production results in the emission of carbon and hydrogen sulfides and oil mists. Activated carbon adsorption can be used for odour control.

Fertilizer plants emit ammonia, nitric oxides, and hydrogen fluoride. Scrubbers are commonly used for gaseous control and ammonia recovery. Particulate matter is produced in the prilling operation; cyclones may be used for product recovery and pollution control.

Petroleum refining produces particulates (catalyst fines), hydrocarbons, sulfur oxides, hydrogen sulfide, carbon monoxide, nitrogen oxides and ammonia. Various absorption, adsorption and catalytic incineration devices are used in addition to recovery systems. Electrostatic precipitators are used for particulate control on catalytic crackers.

3. Food Sector

Grain dehydrating and grinding plants produce significant particulate emissions. Cyclones with baghouses as secondary treatment are used for product recovery and air pollution control.

Grain elevators produce fine dusts in their transfer and cleaning operations. Baghouses are commonly used for product recovery and air pollution control.

Rendering plants are sources of odours. Adsorption, scrubbing with an oxidyzing solution, and incineration are used as control.

4. Pulp and Paper Industry

Sulfur dioxide emissions from recovery furnace operations may be controlled by scrubbing.

Particulates in the kraft (sulfate) process include fly ash from wood burning, furnace particulates from coking chemicals and stack

articles from lime kilns. Gaseous pollutants originating in sulfite and sulfate processes include sulfur dioxide from recovery furnace and boiler operations. Most mills employ scrubbers and electrostatic precipitators as control devices.

5. Miscellaneous Industries

The spectrum of pollutant sources is too large to enumerate here. However the three largest industry groups evident in Ontario from the analysis of this report are the: (1) asphalt and concrete manufacturers; (2) motor vehicle and vehicle parts manufacturers; and (3) metal fabricating shops.

SOURCE OF DATA

Section 8. of Part II of The Environmental Protection Act requires that the Ministry of the Environment issue a certificate of approval for any emission or potential emission to the atmosphere. (see Appendix 1 for actual wording). The equipment specified in applications for certificates of approval forms the basis for the analysis of air pollution control equipment in this report, with the exception of combustion equipment (not considered as pollution control equipment) and retail requirements (total value is small).

No costs are recorded in this section with respect to applications for approval for changes to industrial processes. There is no particular justification for assigning a part or all of such expenditures as a "pollution control" cost unless the reasons for the process change are known in detail. Furthermore, direct expenditures on environmental improvement projects are not included unless there is an associated equipment expenditure. Such items as acoustic barriers and dispersion stacks are not shown. Only expenditures to purchase and install end-of-line environmental equipment are shown.

A copy of an application form for a certificate of approval is attached as Appendix 2. The application requests equipment specifications and

estimates of costs broken down into Equipment, Other and Labour. Before 1977, cost information and equipment specifications were frequently missing. In these cases, historical costs (and in some cases equipment specifications) were estimated from 1977 data. Appendix 3 gives the algorithm used in estimating missing specifications and costs, and a check on the validity of all the cost figures against recently published statistics on equipment costs in the United States.

Prices were adjusted for inflation only, using the Southam Construction Composite Cost Index (See Appendix 4). Prior to 1974, the year of application for certificates could not be readily determined, so historical data is limited to 1974, 1975, 1976 and 1977. Any price fluctuations which may have occurred during this time cannot be accounted for. For all expenditures in this section, the year of the application for certificate of approval and the year of actual expenditure are assumed to coincide.

ANALYSIS

Tables I, II, III, and IV provide by sector for 1974, 1975, 1976 and 1977:

- The total demand for the four major end-of-line equipment types;
- The point of manufacture (classified as Canadian, Import, or Unknown) and the air flow through the device (CFM);
- The cost to the purchaser of the equipment ($ Value Equip.) and the cost to the purchase of having the equipment installed ($Value Inst.);
- Records of the installations of a number of low-demand items, including regenerative carbon filters for adsorbers, cooling towers, fume incinerators, flares, mist eliminators, afterburners, absorbers, adsorbers and paint spray booths.

The classification "Unknown" was applied to every equipment item where either the manufacturer could not be identified, or the manufacturer's name was known but the nationality of the manufacturer could not be determined.

It is expected that most of the "Unknown" items are produced by small fabricators.

Cooling towers and paint spray booths are shown in the Tables only because they require Ministry approval (cooling towers generate visible plumes and paint spray booths are a common source of odour complaints). Both of these types of equipment are over 90% of Canadian origin. The other seven low-demand items have a high combined American content:

- The nine known flare imports were all produced by National Airoil Burner Company, Philadelphia, Pa;
- American afterburners outnumber Canadian afterburners by about four to one (probably more in terms of value, since they tend to be larger);
- The larger filter elements (all imported) are all produced by Farr Inc., of California.

If, as is expected, the source of data used here does not represent the total Ontario demand for these items, there may be some potential for licensing arrangements to be made by Canadian manufacturers.

ALL ANALYSES IN THIS REPORT CONSIDER ONLY THE DEMAND FOR AND COSTS OF THE FOUR MAJOR END-OF-LINE TYPES OF EQUIPMENT: BAGHOUSES, SCRUBBERS, ELECTROSTATIC PRECIPITATORS AND CYCLONES.

Aside from the inclusion of the other low demand and/or peripheral equipment in the following tables, no further references to them will be made.

AIR POLLUTION EQUIPMENT INSTALLED IN ONTARIO

TABLE I

YEAR: 1974

EQUIPMENT	MINING & METAL PROCESS				CHEMICAL				FOOD				PULP & PAPER				MISC.				TOTALS			
	No.	CFM	$ Value		No.	CFM	$ Value		No.	CFM	$ Value		No.	CFM	$ Value		No.	CFM	$ Value		No.	CFM	$ Value	
			Equip	Inst			Equip	Inst			Equip	Inst			Equip	Inst			Equip	Inst			Equip	Inst.
BAGHOUSE																								
Canadian	18	823	1646	823	12	389	933	522	12	111	144	76	1	15	22	13	28	519	742	438	71	1857	3487	1872
Import	2	31	62	31	2	21	51	28	2	16	21	11	-	-	-	-	18	294	420	248	24	362	554	318
Unknown	1	13	26	13	1	30	72	40	2	16	21	11	-	-	-	-	4	165	236	139	8	224	355	203
Total	21	867	1734	867	15	440	1056	590	16	143	186	98	1	15	22	13	50	978	1398	825	103	2443	4396	2393
SCRUBBER																								
Canadian	4	72	140	84	8	145	281	169	3	74	144	86	1	20	39	23	6	118	229	137	22	429	833	499
Import	1	60	116	70	3	60	116	70	3	60	116	70	2	40	78	46	1	6	12	7	10	226	438	263
Unknown	1	20	39	23	2	27	52	31	-	-	-	-	-	-	-	-	7	207	402	241	10	254	493	295
Total	6	152	295	177	13	232	449	270	6	134	260	156	3	60	117	69	14	331	643	385	42	909	1764	1057
ELEC. PRECIP.																								
Canadian	-				-				-				-				3				3			
Import	-				-				-				-				-				-			
Unknown	-				1				-				-				-				1			
Total	-				1				-				-				3				4			
CYCLONE																								
Canadian	-	-	-	-	10	310	71	19	3	25	24	6	3	69	16	4	19	295	68	18	35	699	179	47
Import	3	212	49	13	1	31	7	2	9	58	56	15	1	31	7	2	4	93	21	6	18	425	140	38
Unknown	-	-	-	-	-	-	-	-	1	7	7	2	-	-	-	-	9	223	51	14	10	230	58	16
Total	3	212	49	13	11	341	78	21	13	90	87	23	4	100	23	6	32	611	140	38	63	1354	377	101
FILTER																								
Canadian	-				-				-				-				-				-			
Import	-				1				-				-				1				2			
Unknown	-				-				-				-				-				-			
Total	-				1				-				-				1				2			
COOLING TOWER																								
Canadian	2				2				-				-				3				7			
Import	-				-				-				-				-				-			
Unknown	2				-				-				-				1				3			
Total	4				2				-				-				4				10			
FUME INCINERATOR																								
Canadian	-				-				-				-				3				3			
Import	-				-				-				-				1				1			
Unknown	-				1				-				-				1				2			
Total	-				1				-				-				5				6			
FLARE																								
Canadian	-				-				-				-				-				-			
Import	-				2				-				-				-				2			
Unknown	-				2				-				-				-				2			
Total	-				4				-				-				-				4			
MIST ELIMINATOR																								
Canadian	-				1				-				-				1				2			
Import	-				1				-				-				1				2			
Unknown	-				1				-				-				-				1			
Total	-				3				-				-				2				5			
AFTERBURNER																								
Canadian	-				1				-				-				1				2			
Import	-				-				-				-				-				-			
Unknown	-				-				-				-				-				-			
Total	-				1				-				-				1				2			
ABSORBER																								
Canadian	-								-				-				-				-			
Import	-				-				-				-				-				-			
Unknown	-				-				-				-				-				-			
Total	-				-				-				-				-				-			
ADSORBER																								
Canadian	-				-				-				-				-				-			
Import	-				-				-				-				-				-			
Unknown	-				-				-				-				-				-			
Total	-				-				-				-				-				-			
PAINT SPRAY BOOTH	-				-				-				-				41	446	71	36	41	446	71	36
TOTAL	30	1231	2078	1057	40	1013	1583	881	35	357	533	277	8	175	162	88	99	1920	2181	1248	212	4706	6537	3551

TOTAL of BAGHOUSE, SCRUBBER, ELEC. PRECIP. & CYCLONE ONLY.

AIR POLLUTION EQUIPMENT INSTALLED IN ONTARIO

TABLE II

YEAR: 1975

EQUIPMENT	MINING & METAL PROCESS.				CHEMICAL				FOOD				PULP & PAPER				MISC.				TOTALS			
	No.	CFM	$ Value		No.	CFM	$ Value		No.	CFM	$ Value		No.	CFM	$ Value		No.	CFM	$ Value		No.	CFM	$ Value	
			Equip	Inst			Equip	Inst			Equip	Inst			Equip	Inst			Equip	Inst			Equip	Inst
BAGHOUSE																								
Canadian	31	917	2286	1148	27	651	1953	1088	43	731	1272	672	1	16	28	17	55	605	1059	608	157	2920	6598	3533
Import	8	94	232	116	7	205	615	342	1	5	9	5	-	-	-	-	29	382	683	364	45	686	1539	827
Unknown	2	24	59	30	8	207	621	345	2	13	22	12	-	-	-	-	10	217	376	217	22	461	1078	604
Total	41	1035	2577	1294	42	1063	3189	1775	46	749	1303	689	1	16	28	17	94	1204	2118	1189	224	4067	9215	4964
SCRUBBER																								
Canadian	7	108	263	156	-	-	-	-	1	1	2	1	3	60	144	86	3	60	144	86	14	229	553	329
Import	2	11	24	15	2	40	96	58	4	68	163	97	1	20	48	29	4	93	222	133	13	232	553	332
Unknown	-	-	-	-	10	200	480	288	2	40	96	58	1	42	100	60	6	82	154	91	19	364	830	497
Total	9	119	287	171	12	240	576	346	7	109	261	156	5	122	292	175	13	235	520	310	46	825	1936	1158
ELEC. PRECIP.																								
Canadian	4	40	304	152	-	-	-	-	-	-	-	-	1	10	76	38	-	-	-	-	5	50	380	190
Import	-	-	-	-	3	30	228	114	-	-	-	-	-	-	-	-	-	-	-	-	3	30	228	114
Unknown	-	-	-	-	-	-	-	-	-				1	10	76	38	1	14	106	52	2	24	182	90
Total	4	40	304	152	3	30	228	114	-				2	20	152	76	1	14	106	52	10	104	790	394
CYCLONE																								
Canadian	-	-	-	-	2	62	18	5	2	18	21	6	-	-	-	-	-	-	-	-	4	80	39	11
Import	-	-	-	-	2	62	18	5	2	14	17	4	-	-	-	-	4	124	36	10	8	200	71	19
Unknown	1	31	9	3	9	248	73	21	3	22	26	7	1	30	9	3	3	63	19	6	17	394	136	40
Total	1	31	9	3	13	372	109	31	7	54	64	17	1	30	9	3	7	187	55	16	29	674	246	70
FILTER																								
Canadian	2				1				-				-				-				3			
Import	-				-				4				-				-				4			
Unknown	-				2				1				-				4				7			
Total	2				3				5				-				4				14			
COOLING TOWER																								
Canadian	3				4				1				-				1				9			
Import	-				-				-				-				-				-			
Unknown	1				-				-				-				-				1			
Total	4				4				1				-				1				10			
FUME INCINERATOR																								
Canadian	-				1				-				-				2				3			
Import	-				-				-				-				1				1			
Unknown	-				1				-				-				1				2			
Total	-				2				-				-				4				6			
FLARE																								
Canadian	-				-				-				-				-				-			
Import	-				1				-				-				-				1			
Unknown	-				2				-				-				-				2			
Total	-				3				-				-				-				3			
MIST ELIMINATOR																								
Canadian	1	12			-				-				-				10	65			19	77		
Import	-	-			-				-				-				-	-			-	-		
Unknown	1	5			-				-				-				-	-			1	5		
Total	2	17			-				-				-				18	65			20	82		
AFTERBURNER																								
Canadian	-				-				-				-				1				1			
Import	-				-				1				-				-				1			
Unknown	1				-				-				-				-				1			
Total	1				-				1				-				1				3			
ABSORBER																								
Canadian	-				-				-				-				-				-			
Import	-				-				-				-				-				-			
Unknown	-				-				-				-				-				-			
Total	-				-				-				-				-				-			
ADSORBER																								
Canadian	-				-				-				-				-				-			
Import	-				-				-				-				-				-			
Unknown	-				-				-				-				-				-			
Total	-				-				-				-				-				-			
PAINT SPRAY BOOTH	-				-				-				-				30	336	67	34	30	336	67	34
TOTAL	55	1225	3177	1620	70	1705	4102	2266	60	912	1628	862	9	188	481	271	115	1640	2799	1567	309	5670	12,187	6586

TOTAL of BAGHOUSE, SCRUBBER, ELEC. PRECIP. & CYCLONE ONLY.

AIR POLLUTION EQUIPMENT INSTALLED IN ONTARIO

TABLE III

YEAR: 1976

EQUIPMENT	MINING & METAL PROCESS.				CHEMICAL				FOOD				PULP & PAPER				MISC.				TOTALS			
	No.	CFM	$ Value		No.	CFM	$ Value		No.	CFM	$ Value		No.	CFM	$ Value		No.	CFM	$ Value		No.	CFM	$ Value	
			Equip	Inst			Equip	Inst.			Equip	Inst			Equip	Inst			Equip	Inst			Equip	Inst
BAGHOUSE																								
Canadian	32	567	1685	1508	33	991	3370	1883	59	1854	4386	2385	7	92	197	117	28	434	897	524	159	3938	10,535	6417
Import	4	38	116	58	37	1110	3774	2109	1	5	12	7	-	-	-	-	21	304	642	380	63	1457	4544	2554
Unknown	1	13	40	20	3	9	29	16	-	-	-	-	3	85	202	119	-	-	-	-	7	107	271	155
Total	37	618	1841	1586	73	2110	7173	4008	60	1859	4398	2392	10	177	399	236	49	738	1539	904	229	5502	15,350	9126
SCRUBBER																								
Canadian	9	153	420	258	6	91	245	147	4	46	123	74	4	80	216	128	5	143	387	230	28	513	1391	837
Import	1	8	22	13	3	72	196	117	-	-	-	-	3	45	120	71	3	121	327	195	10	246	665	396
Unknown	-	-	-	-	5	73	124	71	-	-	-	-	1	20	54	32	-	-	-	-	6	93	178	103
Total	10	161	442	271	14	236	565	335	4	46	123	74	8	145	390	231	8	264	714	425	44	852	2234	1336
ELEC. PRECIP.																								
Canadian	1				-				-				-				2				3			
Import	-				-				-				-				-				-			
Unknown	-				-				-				-				-				-			
Total	1				-				-				-				2				3			
CYCLONE																								
Canadian	-	-	-	-	-	-	-	-	2	14	20	5	-	-	-	-	3	39	42	12	5	53	62	17
Import	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	186	66	18	6	186	66	18
Unknown	2	62	22	6	1	31	11	3	8	50	72	20	2	62	22	6	3	86	31	8	16	291	158	43
Total	2	62	22	6	1	31	11	3	10	64	92	25	2	62	22	6	12	311	139	38	27	530	286	78
FILTER																								
Canadian	-	-			1	2			1	5			-				-				2	7		
Import	1	2			-	-			-	-			-				-				1	2		
Unknown	-	-			-	-			-	-			-				-				-	-		
Total	1	2			1	2			1	5			-				-				3	9		
COOLING TOWER																								
Canadian	2				4				4				-				-				10			
Import	-				-				-				-				-				-			
Unknown	3				-				-				-				-				3			
Total	5				4				4				-				-				13			
FUME INCINERATOR																								
Canadian	-				-				-				-				-				-			
Import	1				2				-				-				1				4			
Unknown	-				-				-				-				-				-			
Total	1				2				-				-				1				4			
FLARE																								
Canadian	-				1				-				-				-				1			
Import	1				3				-				-				-				4			
Unknown	-				-				-				-				-				-			
Total	1				4				-				-				-				5			
MIST ELIMINATOR																								
Canadian	-				-				-				-				-				-			
Import	-				1				-				-				-				1			
Unknown	-				1				-				-				-				1			
Total	-				2				-				-				-				2			
AFTERBURNER																								
Canadian	-				-				-				-				-				-			
Import	1				-				-				-				-				1			
Unknown	-				-				1				-				-				1			
Total	1				-				1				-				-				2			
ABSORBER																								
Canadian	-				-				-				-				-				-			
Import	-				-				-				-				1				1			
Unknown	-				-				-				-				-				-			
Total	-				-				-				-				1				1			
ADSORBER																								
Canadian	-				-				-				-				-				-			
Import	-				-				-				-				-				-			
Unknown	-				-				-				-				-				-			
Total	-				-				-				-				-				-			
PAINT SPRAY BOOTH	-				-				-				-				37	423	97	48	37	423	97	48
TOTAL	50	841	2305	1863	88	2377	7749	4346	74	1969	4613	2491	20	384	811	473	71	1313	2392	1367	303	6884	17,870	10,540

TOTAL of BAGHOUSE, SCRUBBER, ELEC. PRECIP. & CYCLONE ONLY.

AIR POLLUTION EQUIPMENT INSTALLED IN ONTARIO

TABLE IV

YEAR: 1977

EQUIPMENT	MINING & METAL PROCESS.				CHEMICAL				FOOD				PULP & PAPER				MISC.				TOTALS			
	No.	CFM	$Value		No.	CFM	$Value		No.	CFM	$ Value		No.	CFM	$Value		No.	CFM	$Value		No.	CFM	$ Value	
			Equip	Inst			Equip	Inst			Equip	Inst			Equip	Inst			Equip	Inst			Equip	Inst
BAGHOUSE																								
Canadian	52	803	2909	1508	26	361	1398	755	49	609	1520	826	1	3	6	4	56	1147	2832	1520	184	2923	8665	4613
Import	6	54	181	105	3	61	251	135	3	23	50	23	-	-	-	-	10	132	303	171	22	270	785	434
Unknown	17	202	734	303	1	4	15	8	4	260	648	352	-	-	-	-	27	463	1162	570	49	929	2559	1233
Total	75	1059	3824	1916	30	426	1664	898	56	892	2218	1201	1	3	6	4	93	1742	4297	2261	255	4122	12,009	6280
SCRUBBER																								
Canadian	12	475	1589	848	8	70	200	106	2	40	128	76	-	-	-	-	9	175	485	354	31	760	2402	1384
Import	1	20	64	38	12	42	148	111	-	-	-	-	1	47	150	90	4	70	176	121	18	179	538	360
Unknown	-	-	-	-	11	160	512	305	-	-	-	-	-	-	-	-	8	180	491	341	19	340	1003	646
Total	13	495	1653	886	31	272	860	522	2	40	128	76	1	47	150	90	21	425	1152	816	68	1279	3943	2390
ELEC. PRECIP.																								
Canadian	13	900	2823	1360	1	20	21	29	1	1	7	5	1	230	520	260	-	-	-	-	16	1151	3371	1649
Import	7	15	633	366	1	20	21	29	-	-	-	-	-	-	-	-	3	6	36	21	11	41	690	416
Unknown	-	-			1	1	3	2	-	-	-	-	-	-			-	-	-	-	1	1	3	2
Total	20	915	3456 *	1726	3	41	45	60	1	1	7	5	1	230	520 *	260	3	6	36	21	28	1193	4064	2067
CYCLONE																								
Canadian	18	574	241	65	2	120	50	12	4	39	65	17	1	31	13	3	3	67	41	10	28	831	410	107
Import	13	333	149	41	18	558	234	63	11	118	199	53	1	28	4	1	15	452	190	51	58	1489	776	209
Unknown	8	180	76	24	3	51	21	6	18	105	235	52	1	238	100	27	11	689	308	83	41	1263	740	192
Total	39	1087	466	130	23	729	305	81	33	262	499	122	3	297	117	31	29	1208	539	144	127	3583	1926	508
FILTER																								
Canadian	1		1	1	1				-				-				23		10	10	25		11	11
Import	9		150	60	-				-				-				2		14	16	11		164	76
Unknown	1		5	2	1				-				-				-		-	-	2		5	2
Total	11		156	63	2				-				-				25		24	26	38		180	89
COOLING TOWER																								
Canadian	-				-				-				-				-				-			
Import	-				-				-				-				-				-			
Unknown	2				-				-				-				-				2			
Total	2				-				-				-				-				2			
FUME INCINERATOR																								
Canadian	-		-	-	-				-				-				1	3	7	3	1	3	7	3
Import	1		7	3	1				-				-				-				2			
Unknown	-		-	-	3				-				-				-				3			
Total	1		7	3	4				-				-				1	3	7	3	6			
FLARE																								
Canadian	-				-			-	-				-				-				-		-	
Import	-				2			40	-				-				-				2		40	
Unknown	-				-			-	-				-				-				-		-	
Total	-				2			40	-				-				-				2		40	
MIST ELIMINATOR																								
Canadian	3				1				-				-				2				6			
Import	-				2				-				-				-				2			
Unknown	2				1				-				1				1				5			
Total	5				3				-				1				3				13			
AFTERBURNER																								
Canadian	-	-	-	-	-	-	-	-	-				-				-				-			
Import	1	4	94	66	4	-	24	6	-				-				4				9			
Unknown	-	-	-	-	-	-	-	-	-				-				1				1			
Total	1	4	94	66	4	-	24	6	-				-				5				10			
ABSORBER																								
Canadian	-				-				-				-				-				-			
Import	-				-				-				-				-				-			
Unknown	1				-				-				-				-				1			
Total	1				-				-				-				-				1			
ADSORBER																								
Canadian	-				-				-				-				-				-			
Import	-				-				-				-				-				-			
Unknown	2				-				-				-				-				2			
Total	2				-				-				-				-				2			
PAINT SPRAY BOOTH	-				-				-				-				86	1352	370	185	86	1352	370	185
TOTAL	147	3556	9399	4658	87	1468	2874	1561	92	1195	2852	1404	6	577	793	385	146	3381	6024	3242	478	10,177	21,942	11,245

* Estimated from "Journal of the Air Pollution Control Association - August 1978"

TOTAL of BAGHOUSE, SCRUBBER, ELEC. PRECIP. & CYCLONE ONLY.

A summary of these four Tables is given below:

		No. of Items	Equipment Value ($ millions)	Flow (million CFM)
1974	Canadian	131	4.5	3.0
	Import	52	1.1	1.0
	Unknown	29	0.9	0.7
	Total	212	6.5	4.7
1975	Canadian	180	7.6	3.3
	Import	69	2.4	1.2
	Unknown	60	2.2	1.2
	Total	309	12.2	5.7
1976	Canadian	195	12.0	4.5
	Import	79	5.3	1.9
	Unknown	29	0.6	0.5
	Total	303	17.9	6.9
1977	Canadian	259	14.9	5.7
	Import	109	2.8	2.0
	Unknown	110	4.3	2.5
	Total	478	22.0	10.2

Obviously there has been real growth in the demand for end-of-line air pollution control equipment during the period 1974-1977. The growth in the demand for Canadian products shows extremely high correlation with the overall growth during this period - most of the increasing demand has been picked up by Canadian suppliers.

The percentage of imports to Canadian products dropped significantly in 1977. One would expect the recent drop in the value of the Canadian dollar to continue this trend in 1978, but this has not been explored.

Data is presented later in this report (see page 100) which indicates that the overall growth in demand has probably not continued in 1978.

FUTURE TRENDS

Upcoming demands for air pollution control equipment can be divided into three categories:

1. demands arising from new or expanded production facilities,
2. the demand for replacement equipment,
3. the "backlog" demand remaining from industries which are not yet meeting present regulatory requirements.

This report has not identified either of the first two categories of demand with enough reliability to be included. However, an estimation of the total "backlog" demand was made. Based on regional Industrial Abatement Sections' appraisal of industries not now meeting emission requirements and of the most likely type of equipment that would be utilized, total "backlog" demands are:

Equipment	CFM Million	No. of Items	Equipment Cost $ 1978 Million	Installation Cost $ 1978 Million
BAGHOUSES	9.2	300-400	30.4	16.1
SCRUBBERS	4.4	100-150	15.2	9.1
ELECTROSTATIC PRECIPITATORS	2.8	40-60	12.6	6.4
CYCLONES	0.3	10-15	0.1	-
TOTAL	16.7	450-625	$ 58.3	$ 31.6

Another $28.6 million was identified as requirements not related directly to the purchase and installation of the above equipment. The most common requirements were related to improved control systems and monitoring.

The demand shown for cyclones is recognized as being unrealistically low. The data must be interpreted as meaning that as a type of final treatment, cyclones are going to virtually disappear. However, it is

expected that they will become more commonly used as pre-treatment in conjunction with the other more efficient devices.

The following points must be emphasized:

1. The cumulative figures shown here are not based on technical reviews of individual plant requirements. They are based only on a survey undertaken over a short period of time.

2. There may be many alternative equipment solutions to any emission problem (including a process modification which would remove the need for any control equipment).

3. The time period over which these equipment installations might be made is probably in the order of five years. Some of the requirements are extremely nebulous at the present time.

Nevertheless it appears that:

1. There remains a "backlog" of potential demand for equipment greater than the present annual demand,

2. Electrostatic precipitators will be used much more frequently than in the past,

3. The biggest demand will continue to be for baghouses.

EQUIPMENT MANUFACTURERS IN THE ONTARIO MARKET

The major suppliers of end-of-line air pollution control equipment to the Ontario market over the past four years were, in order of identifiable volume of sales:

CHAPER II

WATER POLLUTION EQUIPMENT

FRAMEWORK FOR ANALYSIS

In this chapter, water pollution equipment is interpreted as being the equipment that industry utilizes for controlling the quality of its wastewater discharges and the various types of equipment that governments utilize in both communal water treatment and communal sewage treatment facilities.

The analysis of water pollution equipment differs from the analysis of air pollution equipment in that for Ontario:

(1) The majority of expenditures are made by municipalities and the Provincial Government rather than by industry. Historical data are known in substantial detail and expenditure forecasts can more easily be made.

(2) Major equipment types are harder to identify by nationality. Whereas for air pollution equipment it is possible to distinguish Canadian products from imports, this is not true for water pollution equipment. The Canadian content of an item may vary anywhere from 0% to 100%. Furthermore, there is a substantial volume of import trade at the sub-component level.

METHODS OF TREATING WASTEWATER

Wastewater treatment may be generally classified as follows:

1. Physical treatment for the removal of suspended solids, foreign objects and grease:

   Screening, pre-aeration, sedimentation and surface skimming are types of physical treatment for which specialized equipment exists.

2. Chemical treatment for the removal of odour, chemical contaminants, dissolved solids, and pathogens:

   Chemical coagulation, pH neutralization and chlorination are common types of treatment.

3. Biological treatment for the removal of organic matter:

   Biological treatment requires aeration equipment to generate the aerobic or anaerobic digestion of solids.

EXAMPLES OF COMMON POINT SOURCES OF WATER POLLUTION AND THEIR TREATMENT

1. Municipalities

   Sewage is the second largest single contributor of suspended solids and BOD in the Province. Secondary treatment is generally provided.

2. Mining and Metal Processing Sector

   Blast furnaces require flue-gas washing (by scrubber) which produces suspended solids, cyanides, phenols and ammonia.

   Steel mills generate oily wastes and acidic wastewaters in the steel-cleansing and rolling processes.

   Copper smelters generate suspended solids in electrolytic solutions.

   Mining operations cause nitrogen, cyanide, and suspended solids loadings from their tailings areas.

   Most treatment operations can be categorized as neutralization and clarification.

3. Chemical Sector

Inorganic chemical production includes the manufacture of acids and alkalies, carbon products, and many industrial gases.

Organic chemical production includes the production of fertilizers, pesticides, most man-made fibres, and plastics.

Inorganic and Organic chemical production involve a sequence of processes with reactants, distillation, crystalization, sedimentation etc. which generate dissolved solids, dissolved gases, nitrogen compounds, oils, suspended solids and phenols in the process wastewaters.

Petroleum refining operations produce acid wastes and catalyst fines in the cracking process, acids and oils in desulfurization process, and organic wastes in the polymerization process.

Although collection and recovery rates of wastes are high for economic reasons, physical, chemical and biological treatment may all be required.

4. Food Sector

Cheese production results in high suspended solids and organic loadings.

Canneries produce suspended solids and BOD loadings in thier washing and blanching operations.

Meat processing plants produce BOD loadings, solids loadings and greasy wastes during slaughtering, eviscerating, cutting operations.

Most wastes are non-toxic and suitable for biological treatment.

5. Pulp and Paper Sector

Pulp and paper mills are the largest single contributors to suspended solids and BOD loadings in the Province. Woodwashing and debarking operations and mechanical pulping generate particles and bacterial counts.

Chemical pulping and pulp bleaching operations generate further BOD and dissolved solids loadings in addition to pH problems. Settling lagoons, primary clarification and stabilization ponds are commonly used as treatment.

For an excellent technical description of industrial wastewater treatment, see Azad (5).

SOURCE OF DATA

Section 42 of Chapter 332 of The Ontario Water Resources Act requires that the Ministry of the Environment issue a certificate of approval for any process which will cause a discharge to a Provincial watercourse. Approvals are therefore required both by industries discharging wastes to watercourses, and municipalities and the Province in the cost of sewage treatment facilities. The costs of all these facilities are available.

Industries which discharge into sewer systems do not require approval from the Ministry of the Environment. Their expenditures and equipment requirements (if any) do not appear in this report. These industries would generally fall into the Miscellaneous Sector.

In a fashion similar to Section 42, Section 41 of Chapter 332 of The Ontario Water Resources Act requires approval for water works proposed by an industry or municipality. Only the costs of municipal water supplies are known. No estimates are made of the cost of industrial water supplies, but it is expected that these are relatively insignificant.

This chapter therefore utilizes only summaries of annual capital expenditures appearing in certificates of approval for:

- Water and sewage treatment works funded by municipalities and the Province;
- Industrial waste treatment works with a discharge to a watercourse.

ANALYSIS

It was considered impossible to calculate historical values of imported equipment because of the variety of items used, the lack of an accessible file on equipment supplies, and the extreme range of Canadian content in individual items of equipment provided by a multitude of suppliers. Therefore this report generates a total value of 1977 equipment costs only, then estimates the value of imports by equipment type for 1977 only.

Table V provides documentation on historical total municipal and Provincial capital expenditures on water and sewage systems in Ontario. These figures include all costs related to the provision of:

- Water treatment facilities
- Water storage facilities
- Water distribution systems
- Sewage treatment facilities
- Sewage collection systems

For 1977, expenditures on equipment are derived as follows:

		($ millions)
(1)	Total Capital Expenditures for 1977	592.3
(2)	Less: Design and Engineering Charges (7.6% of (1))	(45.0)
(3)	Less: Land, Legal, Finance, Misc. Charges (5.0% of (1))	(29.6)
(4)	Total on Physical Construction	517.7
(5)	Less: Storage, Distribution, and Collection Systems (70.0% of (4))	(362.4)
(6)	Total on Water and Sewage Treatment Facilities	155.3
(7)	Total Cost of Uninstalled Equipment (26.0% of (6))	40.4

Total cost of uninstalled equipment was determined from a survey of 11 projects involving the construction of water and sewage treatment facilities only. Costs of equipment were all within the range 22% to 29% of total treatment facility costs, averaging 26%.

The percentage estimates used in (2), (3) and (5) above are commonly accepted within the Ministry of the Environment as representative figures for these items.

Klein and Leung (6) claim that in the case of primary treatment, equipment costs are generally 2 - 3% of total capital costs excluding land, legal and finance charges, whereas the addition of equipment for secondary treatment adds another 4 - 6% to equipment costs. The figure calculated in the steps above, amounts to 7.4% of total capital costs less land, etc.; this is about midrange in Klein and Leung's 6 - 9% range for secondary treatment. Klein and Leung also claim that as a percentage of secondary treatment facility costs, equipment costs will be in the range of 20 - 28%. This is also in line with the 22 - 29% found here.

Appendix 9 provides summaries since 1967 of total capital expenditures for industrial wastewater treatment works as stated in applications for certificates of approval. The industry classification in the top half

of the Appendix is used within the Ministry; the classification at the bottom was defined on page 5.

Since industrial wastewater treatment facilities do not require extensive collector systems, this report assumes:

		($ millions)
(1)	Total Capital Expenditures for 1977	40.1
(2)	Less: Design and Engineering Charges (7.6% of (1))	(3.0)
(3)	Less: Land, Legal, Finance, Misc. Charges (5.0% of (1))	(2.0)
(4)	Total on Physical Construction	35.1
(5)	Total Cost of Uninstalled Equipment (26.0% of (4))	9.1

To analyze the value of imported equipment and subcomponents for 1977 associated with the total $49.5 million combined industrial, municipal and Provincial expenditures for uninstalled equipment, it was necessary to group numerous equipment items into a small number of categories, deduce the relative value of each category, then judge the overall Canadian content of each category from rather sparse information on the Canadian content of a large number of suppliers.

The result is as follows:

Category	% of Total Equipment Cost	1977 Value $ million	Overall % Canadian Content	Value of Imports $ million
Pumps and pumping stations	30 %	14.9	50 %	7.5
Mechanically-cleaned screens, comminution devices and degritters	8 %	4.0	70 %	1.2
Sedimentation and clarification equipment	9 %	4.5	75 %	1.1
Chemical feed equipment, mixers, agitators, flocculators and chlorinators	12 %	5.9	40 %	3.5
Aeration equipment (blowers, nozzles, air diffusers, compressors)	12 %	5.9	50 %	3.0
Sludge digestion and dewatering equipment	12 %	5.9	70 %	1.8
Valves	17 %	8.4	70 %	2.5
Total	100 %	49.5		20.6

This method of analysis gives an overall import content of 42%. I expect the actual rate may be higher. Cost curves for some specific items of equipment are given in Appendix 10.

In the case of air pollution equipment, it was mentioned (p. 20) that 1978 imports would probably drop based solely on the higher value of the American dollar. This is probably not true in the case of water pollution equipment. There is an extremely high flow of sub-components into Canada, and few Canadian firms not dependent on the import of these items. The significance of imports becomes clearer by looking at commodity imports at the Federal level (see p. 84).

FUTURE TRENDS

The provision of funds by municipalities and the Provincial government for water and sewage treatment projects has shown continual historical growth. (See Table V, p. 38). The results of these expenditures, in terms of the numbers, type and capacity of facilities, is shown below. The first column represents the cumulative impact of expenditures up to 1975, while the second and third columns represent the impact of 1976 and 1977 expenditures.

SUMMARY OF COMMUNAL† SEWAGE TREATMENT FACILITIES IN ONTARIO

Treatment Type	1975		1976		1977	
	No. Plants	Capacity (MIGD)	No. Plants	Capacity (MIGD)	No. Plants	Capacity (MIGD)
Primary	44	223.4	39	210.8	39	229.9
Secondary	157	709.0	167	786.7	168	814.2
Lagoons	108	29.2	131	34.9	133	38.8
Total	309	961.6	337	1031.4	340	1082.9

SUMMARY OF COMMUNAL† WATER TREATMENT FACILITIES IN ONTARIO

Treatment Type	1975		1976		1977	
	No. Plants	Capacity (MIGD)	No. Plants	Capacity (MIGD)	No. Plants	Capacity (MIGD)
No Treatment	233	324.7	227	386.8	221	368.6
Chemical Treatment	23	52.0	37	67.9	44	75.5
Physical Treatment	49	153.1	45	78.7	43	100.1
Chemical & Physical Treatment	96	1170.6	101	1328.6	110	1316.6
Total*	401	1700.4	410	1862.0	418	1860.8

Source of data: *Water and Sewage Treatment Works in Ontario 1975.*
Water and Sewage Treatment Works in Ontario 1976.
Preliminary computer printouts for 1977.

† *Municipal and Provincial ownership only.*

* *Excluding area water supply systems.*

These figures are net, and do not indicate the number of new plants being commissioned or the number of old plants being phased out.

There is increasing evidence that the historical growth pattern of Table V will not continue, for the following reasons:

1. Ministry of the Environment expenditures will be constrained in accordance with the overall reduction in growth of the Provincial budget.

2. The "up-front grant" program introduced by the Provincial government in 1978 means that municipalities will have to borrow their own capital requirements on the money markets, for most new projects. Costs to municipalities will probably be higher and there may be more hesitation by municipalities to proceed with projects.

3. There is more consideration of alternatives to traditional communal treatment facilities in high cost, low growth areas. The Province began assisting municipalities financially to explore private sewage alternatives this year.

4. Ontario presently has the highest degree of communal servicing in Canada. Over 94% of the urban population is serviced by communal sewage treatment, and over 98% of the urban population is serviced by communal water treatment. The need for expanded servicing is rapidly diminishing.

5. Population growth rates are being revised downwards, and there will be less need to provide for new growth.

6. Present levels of treatment are high. Secondary and tertiary sewage treatment, and combined physical and chemical water treatment are prevalent.

(In fairness it should be pointed out that predictions of an imminent drop in expenditures for water and sewage have been made every year since the early 1970's, and none of these have turned out to be true.)

The following projections are made for the four-year period 1979-1982 based on a flat-line $590 million expenditure annually:

		($ millions)
(1)	Total expenditures on physical construction	2,080
(2)	Less: Water distribution and sewage collection (60% of (1) rather than historical 70%)	(1,250)
(3)	Total Water and Sewage Treatment Facilities	830
(4)	Total Value of Uninstalled Equipment	215

In Summary:

1. A decrease is expected in expenditures on collection and distribution systems relative to the past. The major collection and distribution systems required are now in place, and the lifetime of these systems is extremely long.

2. An increase in equipment requirements (from about $40 million to about $50 million annually) is expected, resulting from equipment replacement requirements, changes in treatment type.

Moreover:

3. All projects anticipated are of a "normal" size range, and the importation of specialized "over-sized" equipment should decrease. No projects such as the York-Durham (40 MIGD) or South Peel (138 MIGD) schemes are anticipaed for at least 10 years.

4. The proportion of expenditures on sewage treatment relative to water treatment is expected to rise.

Diagrams VI and VII, pages 39 and 40, provide an indication of major changes expected in water and sewage treatment in the Province over the next four years, based on annual $590 million expenditure.

As a rule of thumb:

- An increase in capacity of more than 90% generally requires a complete new facility;
- An increase in capacity of less than 30% generally means minor equipment changes (larger pumping capacity, etc.)

Information on the types of treatment and capacity changes were derived from the Utility Long Range Requirements Information System, Pollution Control Branch, with the total number of projects adjusted to fit a total expenditure of $2,080 million.

These diagrams might be useful to manufacturers in anticipating major equipment demands over the medium term.

TABLE V

ACTUAL AND ESTIMATED CAPITAL EXPENDITURES FOR
WATER AND SEWAGE SYSTEMS IN ONTARIO

1966 - 1982

($ millions)

Calendar Year	Ontario Total Water and ** Sewage Expenditure	MOE Contribution
1966	170.7	25.0
1967	150.9	19.2
1968	169.0	15.2
1969	154.1	33.7
1970	208.0	52.4
1971	242.6	59.8
1972	288.3	80.4
1973	319.0	81.5
1974	456.1	131.5 *
1975	518.7	166.0 *
1976	533.9	157.6 *
1977	592.3	157.1 *
1978	590.0	181.8 *
1979	590.0	186.5 *
1980	590.0	178.2 *
1981	590.0 †	
1982	590.0 †	

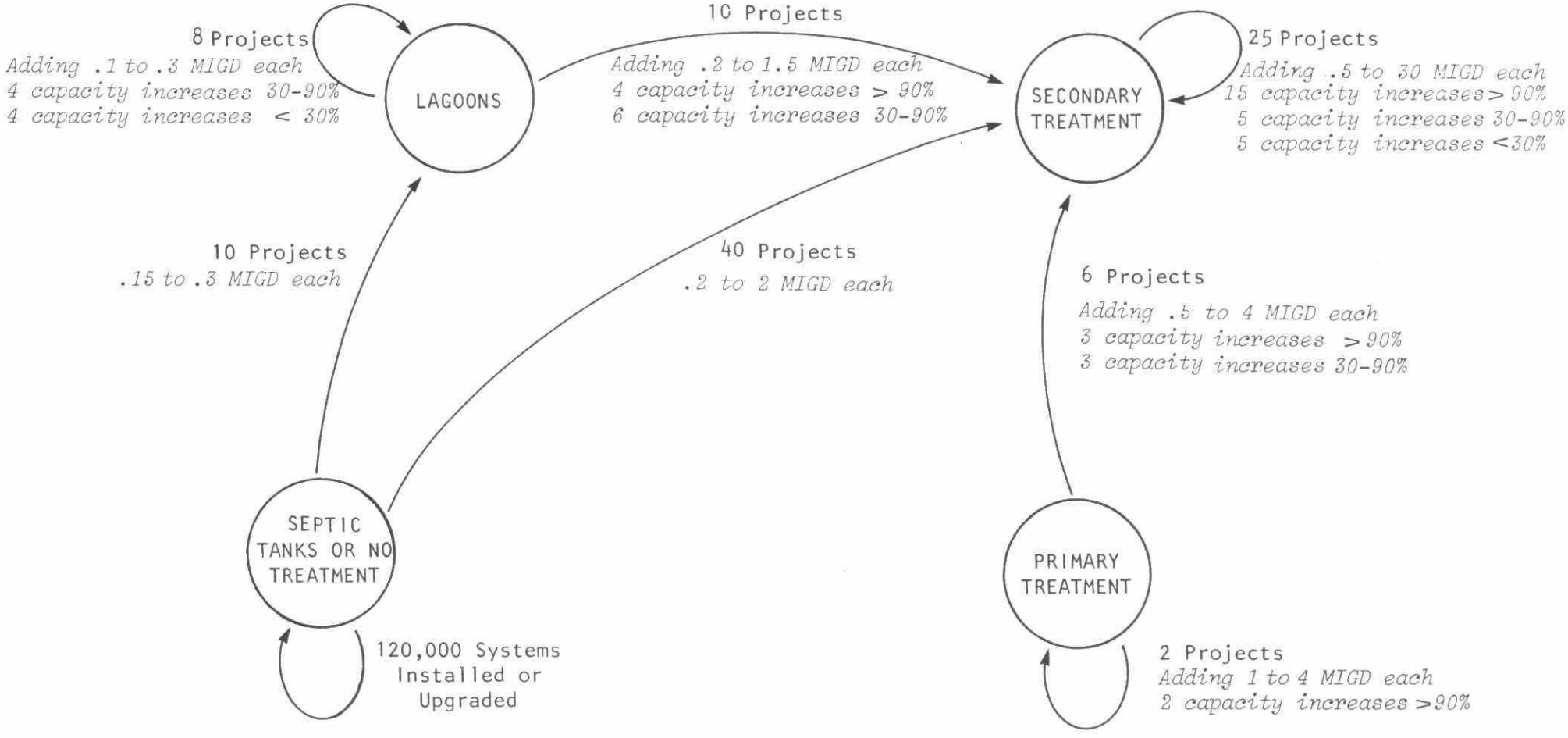
** *Source: Statistics Canada (Up to 1977)*

* *Includes Transfer Payments to Municipalities*

† *Estimated*

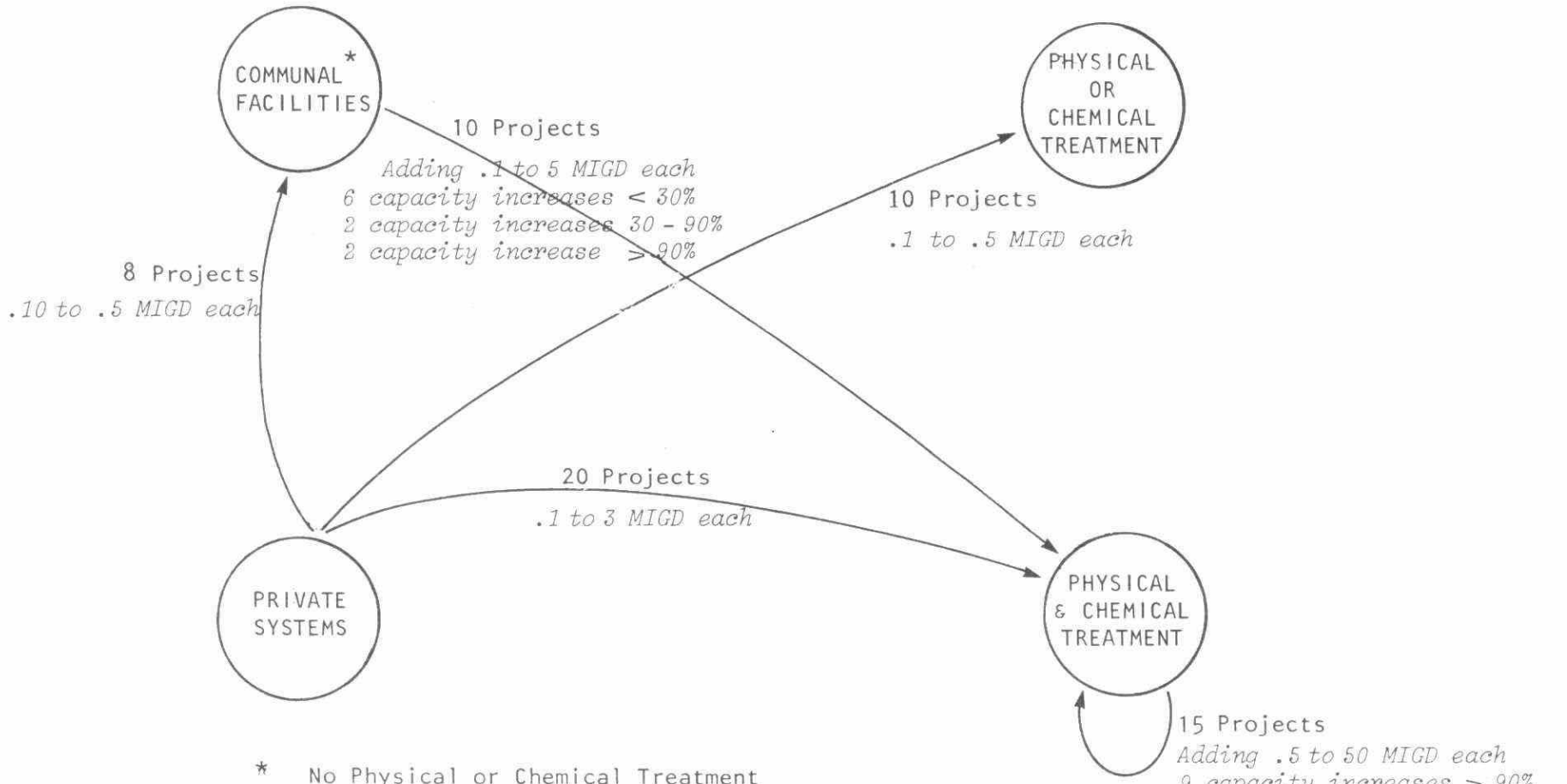
DIAGRAM VI

ESTIMATION OF MODIFICATIONS** TO SEWAGE TREATMENT FACILITIES DURING THE PERIOD 1979 - 1982



** Excluding all process or equipment changes not resulting in at least a 10% increase in plant capacity.

ESTIMATION OF MODIFICATIONS TO WATER TREATMENT FACILITIES** DURING THE PERIOD 1979 - 1982



* No Physical or Chemical Treatment

** Excluding all process or equipment changes not resulting in at least a 10% increase in plant capacity.

EQUIPMENT MANUFACTURERS IN THE ONTARIO MARKET

The major suppliers of water pollution control equipment to the Ontario market up to 1977 are listed by equipment type and identified volume of sales in Appendix 11. The names are, nearly without exception, those of major American companies having a dominant share of the U.S. market.

Dorr-Oliver, in Orillia, has the only plant employing more than 100 on pollution equipment. It has a very high Canadian content. For the remainder of the foreign-owned firms, their Canadian "value added" is much less than that of the American-based air pollution equipment manufacturers. "Fabrication" would be a more accurate term than "manufacturing" for describing a number of the facilities.

Many import some product lines from their American parent firms in addition to manufacturing in Canada. For instance, the Ministry's Operating Summary for Water Pollution Control Projects, 1976 indicates that over 60% of Ministry operated plants have comminutors supplied either by Chicago Pump or Worthington. Both companies have some representation in Canada, but these particular items are imported.

PRESENT EMPLOYMENT

This section summarizes estimates and known figures for the following categories of employment in Ontario related to water pollution control:

1. Employment in the manufacture and marketing of water pollution equipment and chemicals;

2. Employment in the manufacture of pipe and fittings for water distribution and sewage collection systems;

3. On-site employment for the construction of water, wastewater, and sewage treatment systems;

4. Employment related to the design and engineering of treatment systems;

5. Employment related to the installation of private sewage systems;

6. Employment in the operation of Municipal and Provincial treatment systems.

---

1. Employment in the manufacture and marketing of water pollution equipment and chemicals:

A list of 58 manufacturers and agents supplying equipment and chemicals to the Ontario market is given in Appendix 12. Again, the figures listed are corporate estimates of the number of environmentally-related jobs. To an even larger extent than in the case of firms dealing with air pollution, the independence of the smaller companies could not be determined. Most of these companies promote at least one line of imported goods, and there appears to be very little equipment specialization. As of July, 1978 the employment is roughly:

- Manufacture and marketing of equipment and chemicals	1,078
- Agents only	64
	1,142

2. Employment in the manufacture of pipe and fittings for water distribution and sewage collection systems:

Pipe and fittings were not considered to be "equipment" for the purpose of this study but there is no question as to the 100% Canadian supply of these materials. Employment data is incomplete, but a reasonable figure would be: 450

(4 of these are listed in Appendix 12).

3. On-site employment for the construction of water, wastewater and sewage treatment systems:

Previous internal Ministry reviews have shown that every one million dollars of capital expenditure generates approximately 20 man-years of on-site employment. The latest estimates of $590 million (1978 municipal) and $40 million (1977 industrial) would give: 12,600

4. Employment related to the design and engineering of treatment systems:

Using the same methodology as on page 23 gives: 1,196

The employment in the operation of industrial wastewater treatment systems is not known.

5. Employment related to the installation of private sewage systems:

There are approximately 30,000 private sewage systems installed annually in Ontario. The mechanical equipment component of these systems is negligable, but installation of a system (including trench digging, tile and pipe laying, tank installation and grading) takes an average of 6 days. A 250 day season gives an employment figure of: 720

THE WATER, WASTEWATER AND SEWAGE TREATMENT SYSTEMS INSTALLED EACH YEAR IN ONTARIO ARE SUPPORTING APPROXIMATELY 16,108 PRIVATE SECTOR JOBS.

6. Employment in the operation of Municipal and Provincial treatment systems:

The present number of plant operations staff is estimated to be: 2,804

TOTAL WATER TREATMENT EMPLOYMENT IS OVER: 18,912

THE CANADIAN SCENE - 1977

The Canadian capital expenditures on communal water and sewage treatment services totalled $1,586 million in 1977. Assuming the same percentage of equipment requirements as Ontario (p. 31) gives an equipment expenditure of $108.2 million.

Extrapolating 1977 industrial wastewater treatment expenditures from Ontario ($9.1 million) to Canada using Appendix 7 gives an industrial wastewater equipment expenditure of $23.6 million.

Imports were calculated on page 33 to fill 42% of the Ontario demand. If this is also true for Canada, then:

- Canadian expenditures on (uninstalled) water pollution equipment totalled ..... $131.8 million

- Imports of foreign-made items and components totalled ..... $ 55.4 million

SUMMARY

The Canadian water pollution equipment market, which is probably one-twentieth the size of the American market, is too small to support a significant manufacturing base by Canadian-owned firms in addition to the branch-plant operations (with Canadian content from 5% to 90%) of nearly every large American manufacturer. The market is greatly fragmented, with intense price competition on some product lines.

- There is little Canadian development of technology without an adequate domestic base for Canadian manufacturers;

- There is little chance of Canadian firms developing to a state of independence and maturity where export worldwide market can be sought;

- Most of the Canadian job content is in fabrication.

Since many of the items used in water pollution control have general widespread industrial use (particularly pumps and valves) there is a fundamental problem in this area that should be further analyzed. There is a net import of pumps and pump parts alone into Canada of nearly $60,000,000 (see Appendix 8).

Gilmour (7) points out that Canada has, until recently, made modest gains in the development of its manufacturing sector without developing an associated technological capacity, by relying on imported technology. He suggests, the country is now about to lose any gains made in the past.

The Science Council of Canada's latest annual report apparently goes into some detail on the need for a new industrial strategy, for the same reasons.

These are all issues far beyond the terms of reference of this report. There is, however, one action at the Provincial level which should be considered - namely revisions to the Provincial purchasing policy giving a price preference of up to 10% on Canadian content of goods and services supplied to the Government. It appears that in a marketplace with:

- a small number of Canadian-owned manufacturers with a small range of products;

- a large number of foreign-owned manufacturers with many product lines of varying Canadian content;

- a large number of importers,

the policy primarily influences purchasing decisions between the last two categories (away from the importers and to the foreign-owned firm).

Where assistance is required is in expanding the product lines of Canadian-owned manufacturers. As it stands now, the policy probably assists foreign-owned manufacturers (in their competition with imports) more than it does the Canadian-owned firm (in its competion with foreign-owned firms).

RECOMMENDATION:

THAT THE GOVERNMENT REVIEW THE PRESENT PURCHASING POLICY TO DETERMINE IF IT IS ACTING IN THE LONG-TERM INTEREST OF THE CANADIAN MANUFACTURING INDUSTRY.

There is some opinion in the Ministry of the Environment that the administrative requirements of the policy (as stated in the Manual of Administration) detract from the intended effectiveness of the program, and that the policy has only resulted in all suppliers raising their prices to the Government.

CHAPTER III

THE POLLUTION CONTROL EQUIPMENT INDUSTRY

The focus in this chapter is on the air and water pollution control equipment "industry", rather than on the specific equipment produced or the individual firms producing that equipment. The conclusions of this chapter form the basis for many of the recommendations made.

OVERVIEW: WHERE POLLUTION CONTROL EQUIPMENT MANUFACTURING FITS IN

The manufacturing sector of the Canadian economy contains 20 "Major Groups" of industries (see (2)). Major Group 14 - Machinery Industries (except Electrical Machinery) had, in 1975, a production value of about $5 billion, with approximately 120,000 employees in 2,000 companies. It accounts for 6% of the total value of manufactured products. There is a further breakdown of Major Group 14 into four "Industry Numbers":

- 311 - Agricultural Implement Industry
- 315 - Miscellaneous Machinery and Equipment Manufacturers
- 316 - Commercial Refrigeration and Air Conditioning Equipment Manufacturers
- 318 - Office and Store Machinery Manufacturers

The Miscellaneous Machinery and Equipment Manufacturers industry covers the operation of establishments primarily engaged in manufacturing machinery and equipment for the construction and mining industries, the pulp and paper industry, the textile industry, the food processing industry, for materials handling, for woodworking, and for a multitude of purposes "not elsewhere specified".

As of 1975, the Miscellaneous Machinery and Equipment Manufacturers Industry had shipments valued at about $2.4 billion from 873 establishments.

A listing of the 250 or so major products of the Miscellaneous Machinery and Equipment Manufacturers Industry is given in Appendix 13 Three of these products - air purification equipment, dust collecting systems, and water and sewage treatment equipment - represent the output of the pollution control equipment manufacturers.

THE MACHINERY INDUSTRY IN ONTARIO AND CANADA - ITS PERFORMANCE AND PROBLEMS

This section summarizes the findings of two analyses of the machinery industry, one in 1973 and one in 1978:

A. In 1973 the Machinery and Equipment Manufacturers Association of Canada commissioned Dr. G. Lerner of the University of Waterloo to conduct a study (8) on the role of the machinery industry in Canada and on the effect of certain emerging trade policies on this industry. The following conclusions of Lerner's study have some relevance here:

- Machinery industry real domestic product is subject to frequent variation. Equipment among seventy three industries is ranked tenth in demand variation.

- During the sixties the Canadian machinery industry increased its market share in every market except the EEC. This was achieved despite revolutionary productivity and asociated trade gains in both Japan and the EEC. European and Japanese market shares should decline during the seventies. Both the U.S. and Canadian share should increase in most, if not all, markets.

- The Canadian machinery industry has, on the average, supplied about 60% of the Canadian demand for machinery and equipment.

- The Canadian industry's share of the Canadian market has not increased over the past decade.

- The Canadian machinery market is still serviced by a large flow of imports. Though imports increased at about one-half the rate at which exports increased, over the past decade their dollar volume was considerably larger. For total machinery a dollar of extra exports occurred in unison with three dollars and sixty-eight cents worth of extra imports. Exports grew more as a percent of initial values but less by volume than imports.

- Our balance of payments deficit for this sector has been reduced over the decade, not by substituting Canadian machinery for imports, but by increasing machinery exports.

- Canadian owned firms trying to sell on the open U.S. market have faced considerable arbitrariness and non-price, non-quality based competition.

- The foreign-owned firm has easier access to foreign markets, but on the other hand it needs to convince the head office that Canada is a better location for the production of certain lines. Canadian firms can use price competition to give them access to foreign and particularly U.S. markets. Any limitation on access to foreign markets based on price and quality competition alone is very injurious to Canadian owned industry relative to multi-national owned firms located in Canada. It is this issue that bothers the Canadian owned part of the industry. Rationalization is a way out of a profit squeeze in the domestic market, but only for firms with U.S. connections.

- Canadian firms are tied to highly fluctuating market, with severe ups and downs in sales. They will be restricted to a continually receding part of the machinery market -- the made-to-order specialized part. U.S. subsidiaries in Canada will expand at the expense of domestically based firms. As a Canadian market becomes attractive, a U.S. subsidiary will enter it and be able to write off overheads and achieve some other efficiencies of scale by marketing part of its output, or the technology and engineering developed, through foreign marketing channels.

- A one million dollar machinery order in 1973 would increase machinery sector employment by 43 jobs and total employment by 122 jobs.

B. This year a number of Federally-sponsored industry task forces are providing recommendations to the Federal and Provincial governments on the structure, problems and opportunities facing their industries. The Report of the Task Force on The Canadian Machinery Industry, June 1978, draws the following conclusions (see (9)):

- Between 1965 and 1975 machinery industry production increased from $1.8 billion to $5.0 billion, representing an average growth of 11 percent per year. This is similar to the rate of growth of the domestic market which expanded from $3.1 billion to $8.8 billion. However, imports rose from $1.7 billion to $5.5 billion

on a 12 percent average annual growth rate. As a result, imports have been supplying an increasing proportion of the domestic market - from 50 percent in 1965 to 60 percent in 1975. At the same time, Canadian manufacturers increased their exports from $365 million in 1965 to $1.7 billion in 1975, an average annual growth rate of 17 percent. While, in 1965, 20 percent of domestic production was exported, by 1975 this proportion had risen to 35 percent. Nevertheless, the 60 percent share of the domestic market currently supplied from imports reflects an inability to take greater advantage of a large potential demand at home.

- There are about 2,000 machinery companies in Canada ranging from some of the country's largest industrial corporations to local machine shop type establishments employing fewer than 10 people.

  Of these companies, only about 10 percent could be considered medium to large in size in that they employ more than 100 people each; these firms account for close to 70 percent of the total value of the industry's production and overall employment. Most of the larger Canadian machinery manufacturers are foreign-owned and generally smaller than their counterparts in the U.S. and Western Europe.

- Approximately 85 percent of machinery industry activity is concentrated in the urban centres of Ontario and Quebec.

- About 225 large firms in the machinery sector are subsidiaries of parent companies located mainly in the U.S. and they account for at least 50 percent of the sector's total output. The establishment of production facilities in Canada by the large U.S. machinery firms was a gradual process facilitated by a number of factors such as (i) the high tariffs (e.g. 22½ percent) on machinery prior to 1968 which encouraged foreign firms to establish production facilities in Canada to supply the domestic market; (ii) lower Canadian labour rates relative to the U.S.; (iii) the opportunity for a Canadian-based subsidiary to take advantage of British Commonwealth Preferences for sales to Britian, Australia, New Zealand, etc.; (iv) the expansionist practice followed by many U.S. corporations in purchasing existing companies; (v) the need in the Canadian industry to managerial, technical, marketing and financial resources to grow past a certain level of production, and (vi) the attitudes of many marginal Canadian-owned firms which regarded foreign acquisitions as the only means for continued viability or possible expansion.

- The extent to which machinery and equipment trade is carried on by all machinery producing countries is illustrated below:

MACHINERY TRADE BY MAJOR MACHINERY PRODUCING COUNTRIES

Country	% of Domestic Requirements Imported	% of Production Exported
U.S.	10	17
Japan	10	24
West Germany	34	63
Britain	34	50
France	50	45
Sweden	50	59
Canada	60	30

Source: 1973 OECD Market Data.

- Some offset to the impact of intense import competion in the Canadian market has been the growing proportion of domestic production directed to exports. Canadian machinery exports, starting from a small base of $365 million in 1975, increased at an average yearly rate of 17 percent to $1.7 billion in 1975. Exports now represent close to 35 percent of the industry's total output compared to 10 percent 10 years earlier.

- Imports now supply more than 60 percent of Canada's machinery needs as compared to 54 percent in 1965. Approximately one-half of the machinery imported into Canada competes directly with Canadian production. The remainder consists of items for which there is currently no domestic manufacturing capability.

- In addition to complete machines, a significant proportion of Canadian imports consist of components for use in the production of machines in Canada, mainly by subsidiaries producing some of their parent companies' lines. The development of domestic sources of supply for many of these components could assist in reducing the current imbalance in machinery trade. To date, the extent of the problem has been difficult to measure as it is virtually impossible to separately identify the volume of components being imported.

  Many of these component imports are items produced in large quantities in plants in the U.S. and other countries, which could not be duplicated at an economical cost in Canada. While it is undoubtedly true that the production of certain machines on a competitive basis in Canada would not be possible without the importation of key components, manufacturers could perhaps

make greater efforts to develop local sources for components. While the volume of a particular component imported by each firm is often insufficient to support a domestic source of supply, there could be instances where the volume of demand for a particular component might be sufficient in total to develop a Canadian source, if the manufacturers of equipment could standardize their component requirements and agree jointly to support a local source of supply.

- Although the machinery industry has rapidly increased expenditures on research and development over the last decade, these expenditures are still relatively low in comparison to the level of research activity carried out in the U.S.. For instance, it appears that American machinery firms, on average, spend almost twice as much on R & D as Canadians ($48,000 in U.S.; $25,000 in Canada), based on 1972 data.

  The subsidiaries that carry out meaningful innovative activities in Canada are mainly companies with rationalization agreements with their parent corporations under which the Canadian operation has been allocated prime product responsibilities within the corporate organization.

- In 1975 Canada's trade deficit on machinery was $3.8 billion as compared to $1.3 billion in 1965. This means that the trade deficit more than doubled, in real terms, during this period. The imbalance is not confined to any particular product area but extends to virtually all major product groups in the machinery sector. It is, however, particularly significant with respect to the following:

	Trade Deficit 1975
Construction Equipment	$545 million
Agricultural Equipment	$536 million
Special Plant Machinery	$379 million
Rolling Mill, Metalworking Machinery and Machine Tools	$342 million
Pumps, Compressors, Valves, and Bearings	$304 million

Approximately half of the imports of machinery consist of products competing with Canadian production. There are also significant imports of component parts for use in the production of machinery in Canada.

- The propensity on the part of the Canadian industry to import machinery is due to a number of factors, including: (i) the extremely wide range of sizes and types of machinery required by the industry, often in small quantities, with the result that is is uneconomical for the domestic industry to attempt to produce all requirements; (ii) the abandonment of production in certain lines in favour of product specialization in other areas in order to maintain international competitiveness; (iii) tied or concessional financing advantages accruing to offshore suppliers, and to Canadian purchasers, on certain major capital projects in Canada; (iv) the tendency of subsidiary firms in all sectors to Canadian industry to purchase their machinery and equipment requirements on the basis of what is currently in place in their parent's facilities while showing an unwillingness to experiment, with untried or unfamiliar Canadian equipment; (v) the establishment reputation of many foreign machinery manufacturers and their well-developed distribution and servicing network in Canada; (vi) the fact that Canadian manufacturers do not supply complete lines of equipment in many areas; (vii) the practice of foreign consultants involved in projects in Canada to specify foreign equipment because they are unfamiliar with Canadian capabilities; and (viii) the tendency, particularly on the part of subsidiary operations, to import production components from the parent organization for assembly in Canada.

- The scope and nature of any initiatives to achieve a measure of import substitution and ensure successful adjustment to possible tariff reductions under the MTN will have to take into account some basic structural elements peculiar to the machinery sector. These include such factors as:

  -- the predominant position of a small number of subsidiaries that account for the bulk of machinery production as compared to the larger number of generally small and structurally weaker Canadian-owned firms. With regard to the subsidiaries' efforts at achieving more product diversification, access to export markets, increased R & D responsibilities, etc., these imply exerting an influence on foreign management whose motivations may be different from those of Canadian managers. For instance, subsidiaries will have the added task of convincing foreign parents to continue and expand, rather than curtail manufacturing operations in Canada in the event of large tariff reductions following the MTN negotiations. For Canadian-owned companies, initiatives would have to be aimed at strengthening their international stature to ensure they can effectively compete with the large multi-national companies in meeting new demand opportunities in the domestic and export markets.

-- the high degree of selectivity in Canadian machinery production capabilities. In this respect, new initiatives will have to take into account: (a) Canada's basic strengths in custom-engineered equipment; (b) current marginal returns in the production of certain standard machinery products; (c) existing limitations in terms of turnkey capabilities and ability to offer complete systems or integrated plant installations; and (d) choices to be made in the pursuit of import substitution opportunities recognizing the fact that it would be impractical for the industry to attempt to meet all of the diverse range of machinery requirements of the Canadian economy

-- the financial constraints that inhibit the industry from realizing its full potential to meet domestic and export demand opportunities and that perhaps constitute the most significant element in the lack of international stature of the industry. These financial constraints apply to both the Canadian-owned companies, whose financial resources are limited, and the subsidiaries, whose access to parent company resources are circumscribed by the scope of activities entrusted to them. While the machinery sector is affected by financial limitations that are common to other sectors (e.g. scarcity of investment capital, high interest rates, high labour cost, etc.) there are certain aspects peculiar to the nature of machinery industry activity such as: (a) the need to tie up working capital in fulfilling sporadic orders for large machines or systems where production may extend over two years or more; (b) large costs for feasibility studies, for design and engineering and for promotional activities in bidding for capital projects in Canada and abroad; (c) the need to maintain large engineering staffs hold on to skilled employees in periods of cyclical downturns; (d) the difficulties in countering foreign suppliers in bidding for large capital investment in Canada; and (e) the higher rate of capital investment by machinery manufacturers, which will be required in the future, in order to increase their capacity and capability to obtain a larger share of both domestic and export markets.

If the industry is to improve its performance in both the domestic and export markets, investments in new machinery production capabilities and in technological upgrading of facilities will have to surpass the level of investments which this sector achieved over the last decade. The extent to which government can influence the creation of a positive investment climate in the economy will be helpful in achieving this objective.

THE POLLUTION CONTROL EQUIPMENT INDUSTRY IN ONTARIO - OPPORTUNITIES FOR IMPROVEMENT

The previous section dealt with problems of the machinery and equipment industry in general, focussing on:

- the high degree of foreign ownership,
- the large volume of imports overall;
- the large volume of component imports from parent companies to subsidiaries in Canada, where only fabrication takes place, (It is possible that other Canadian companies could supply these components.)
- the ease foreign companies have in setting up market, making it difficult for Canadian firms to become established,
- the established reputation of certain foreign manufacturers and their well-developed distribution networks,
- the practice of foreign owned firms to purchase equipment from their "mother country".

All of these general problems are issues to the pollution control equipment industry in particular. However, the pollution control equipment industry is faced with an even higher degree of foreign ownership and a lower percentage of exports than the overall machinery and equipment industry. It is basically a branch plant industry established to fill Canadian needs only. There are, nevertheless, a number of specific identifiable problems facing this industry, some of which may be solvable either by the Federal Government, the Provincial Government, or the industry itself. These are outlined below, together with certain recommendations.

1. The duty free import of machinery and equipment into Canada under the "Machinery Program" or "Duty Remission Program":

   The Machinery Program came into effect on January 1, 1968 together with other changes in tariffs as a result of the Kennedy Round of

trade talks. Under the Machinery Program, duty otherwise payable on machines, accessories, control equipment, tools and components imported under Tariff Item 42700-1 may be remitted if such goods are not available from production in Canada.

(Tariff Item 42700-1 corresponds essentially with the output of the Miscellaneous Machinery and Equipment Manufacturers Industry classification. It therefore includes pollution control equipment and parts.) Machinery is considered to be available from production in Canada if at least one manufacturer has proven capability to manufacture machinery which, insofar as its range of physical qualities, operational characteristics and efficiency are concerned, is reasonably equivalent to the machinery for which remission is sought.

The stated objectives of this program (see (10)).

a) to increase efficiency throughout Canadian industry by enabling machinery users to acquire advanced equipment at the lowest possible cost, while

b) affording Canadian machinery producers tariff protection on what they manufacture.

This program, while on the surface appears to be in the interest of all parties concerned, has the following weaknesses:

a. There is not an adequate information base available for the administrators of this program to determine what is available from production in Canada. The Machinery Branch of the Department of Industry, Trade and Commerce was not aware of several of the lines of pollution control equipment which Ontario firms are producing.

b. The subsequent importation of replacement parts is granted automatic duty remission for three years after the expiry

date of the original application for duty remission. This obviously has a negative impact on any firm which may be trying to start production during the three-year period.

c. The program fails to deal rationally with special-purpose machinery which is generally not available from production in Canada, but which could be produced by Canadian firms. Under the Machinery Program, such equipment will always be permitted duty-free entry.

d. The phrase "not available from production in Canada" is meant to prevent the duty-free import of equipment for which a reasonably equivalent Canadian alternative is available. However, cases were mentioned to the writer by Ontario's manufacturers where duty remission was allowed on imported goods, because of shorter delivery times, and even different thickness of paint.

The machinery manufacturers appear generally to have an ambivalent outlook on this program. There is some pressure to restrict the application of the program to the manufacturing sector (at the present time, universities, research institutions and governments may apparently apply for duty remission) but there do not seem to have been any attempts to have the program revised or terminated. I expect this is because of the relative insignificance of the equipment manufacturing sector to the overall manufacturing sector, and the reaction that might be expected from the latter.

The Duty Remission Program does accomplish one good thing for the equipment manufacturers - categories of imports which received duty remission are published in order to indicate where new opportunities for domestic production may exist (see (11)).

The basic question that should be answered is:

Would the (presumably) higher costs of production resulting from higher machinery expenses cause a loss of jobs greater than the increase in jobs which would result in the machinery and equipment manufacturing firms if normal tariff rates applied and import substitution resulted ?

I expect not:

- the higher costs of production would be spread among thousands of manufacturing firms, and

- the costs of production machinery have never been put forth as a significant cost to Canadian manufacturers (as opposed to taxes, labor costs, etc.) whereas

- the potential for increased shipments would be consentrated within the eight to nine hundred machinery and eqipment manufacturers.

A number of manufacturers of pollution control equipment indicated that they would increase their product range upon termination of the Duty Remission Program.

Revenue Canada has provided the following information on customs duty remitted on machinery parts:

April 1, 1973 to March 31,	1974	-	$117,977,977.77
1974	1975	-	140,918,940.08
1975	1976	-	146,848,796.44
1976	1977	-	170,168,677.00
1977	1978	-	171,033,037.00

At a tariff rate of 15%, (Most Favoured Nation) this means that over $1.1 billion in machinery and equipment is permitted duty-free entry into Canada - nearly half of the value of production of the Miscellaneous Machinery and Equipment Manufacturing firms.

RECOMMENDATION: - THAT AN ANALYSIS OF THE DUTY REMISSION PROGRAM BE INITIATED TO DETERMINE IF IT IS A NET BENEFIT TO THE CANADIAN ECONOMY;

- IN THE MEANTIME, THAT ELIGIBILITY FOR DUTY REMISSION BE RESTRICTED TO PROVIDE CANADIAN MACHINERY AND EQUIPMENT MANUFACTURERS A BETTER OPPORTUNITY TO FILL SOME OF THE IMPORT DEMAND.

2. The Existence of Non-Tariff Barriers to Export Trade:

Given the degree of foreign (American) ownership of the pollution control industry in Canada, and the fact that the Canadian subsidiaries of the foreign (American) owned firms were established here primarily to serve the Canadian market, the potential for exports to the United States would not appear to be great. However, the Ontario producers are in a favourable geographical location, and it is possible that the relatively low value of the Canadian dollar will encourage the use of more Canadian components and final products in American water treatment facilities.

These positive aspects may never be relevant, because of Section 215 of The Clean Water Act of 1977:

> "Notwithstanding any other provision of law, no grant for which application is made after February 1, 1978 shall be made under this title for any treatment works unless only such unmanufactured articles, materials, and supplies as have been mined or produced in the United States, and only such manufactured articles, materials and supplies as have been manufactured in the United States, substantially all from articles, materials, or supplies mined, produced, or manufactured, as the case may be, in the United States will be used in such treatment works. This section shall not apply in any case where the Administrator determines, based upon those factors the Administrator deems relevant, including the available resources of the agency, it to be inconsistent with the public interest (including multi-lateral government procurement agreements) or the cost to be unreasonable, or if articles, materials, or supplies of the class or kind to be used or the articles, materials, or supplies from which they are manufactured are not mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality.".

This is the so-called "Buy American" clause, a typical non-tariff barrier to trade. It has apparently already caused some loss of business to Canadian firms. The Financial Times of Canada (12) reports that in addition to the Buy America clauses at the Federal level, eighteen states have similar legislation on other products.

The so-called "Heinz Amendments" would furthermore establish a 15% to 50% bid preference for American products in all Federal procurement programs.

It is pointless to go further into the subject on non-tariff barriers to trade in this report, or to try to make recommendations on NTB's. Presumably the Tokyo Round of trade talks will deal with this whole matter.

3. Lack of Promotion of Canadian Products:

Domestically produced products are not distributed in a significantly different way from imported products. Although some of the larger Canadian manufacturers support their own product lines independently, the lines of most Canadian suppliers are usually supported by the same network of sales representatives used by importers. The nationality of equipment is often not apparent.

4. Buyer Attitudes Towards Canadian Products: *

. Industrial end-users of pollution control equipment typically deal with a medium term (say five year) time horizon in their purchasing decisions. Purchasing decisions on production equipment are usually made within the engineering department of the company, or, in the absence of internal expertise, by a consulting engineer.

Industrial buyers appear generally to be unaware of Canadian supplier capabilities. This lack of awareness may be accounted for either because of infrequent purchasing requirements or because of the emphasis placed in the purchasing decision on

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* *Findings by Techno-Economic Research Unit Ltd.*

price and reliability rather than any nationality factors. It is extremely doubtful that any "Buy Canada" program has had, or will have, any effect on industrial buyers of pollution control equipment even if the Canadian content of these products were promoted.

. Municipal buyers rely heavily on consulting engineers to specify and preselect their equipment, using a long-term (say twenty year) time horizon. Consultants typically select equipment based on their own previous experience with its reliability, with price being a secondary factor.

There do not appear to be any policies at the municipal level giving preference to Canadian products. This, in turn, is manifested by a lack of concern over Canadian content with consultants and a general inability on their part even to identify Canadian products.

. The Ministry of the Environment like all Ministries in the Ontario Government, provides a price advantage of up to 10% for Canadian products.

. In summary, industrial end-users of equipment consider price first with reliability a close second in their equipment evaluations. Canadian content is not a factor. Municipal end-users of equipment consider reliability first, with price a secondary factor. Canadian content is at most a remote consideration. Only in the Provincial Government is Canadian content a significant factor in purchasing decisions.

The main reasons why buyers do select foreign equipment are:

a) The higher technical reputation of imports. There is apparently widespread belief that European and American technology is superior to Canadian technoogy;

b) Uncertainty on the part of buyers about the point of manufacture of equipment among the few buyers who are genuinely concerned about Canadian conent;

c) Price: Once technical proficiency is established, the purchasing decision is essentially one of price. After sales service and parts availability are not significant factors in influencing purchasing decisions.

(It is expected that the present low value of the Canadian dollar would have a strong influence on recent purchases, but this was not determined).

d) Influences of foreign parents on purchasing decisions: Foreign-owned firms with Canadian branch plants may rely heavily on their head office for advice and supplier recommendations. These supplier recommendations tend to be of the same nationality as the firm itself.

5. Opportunities for Market Expansion by Canadian Firms are Limited:

a. Foreign control of the industry's output has resulted in fragmentation of the domestic market. (see Lerner's comments on page 49).

b. Foreign owned domestic producers seldom export:

None of the foreign owned manufacturers encountered were permitted to aggressively seek exports to the United States or offshore markets (except when Canadian Export Development Corporation funds were involved). In situations where the market potential here is limited, this policy could effectively eliminate the possibility of growth in the Canadian production levels of these companies. This situation is particularly unfortunate at this time, when the current

weakness of the Canadian dollar has made many foreign markets more accessible.

c. Canadian owned producers lack technological clout:

The ability to successfully market new, technologically superior products in foreign markets is limited by a number of factors mentioned above that influence purchasing decisions. Unfortunately, the domestic market also acts to suppress new product development. This is explained further in the following point.

6. The Ministry of the Environment, which is a major influence on equipment selection in Ontario, has not promoted Canadian products to the fullest extent possible. At present there is little or no support given to pollution control equipment product development in Canada. "Risk minimization" is the prime characteristic of Ministry equipment selection procedures. As an owner of over $2.5 billion of pollution control facilities serving over 2 million people, the entire focus of Ministry programs has been to ensure reliable plant operation. The "role of the prudent owner" has not been balanced by any specific programs to encourage new technological developments by Ontario firms, and probably discourages such developments. This is a growing concern to Ontario manufacturers. Ministry support to new products has traditionally been in the area of improvements to high technology monitoring equipment (i.e. the Trace Atmospheric Gas Analyzer), not in control applications where there may be widespread employment implications.

Within the Federal Government, the DPAT Program (Development and Demonstration of Pollution Abatement Technology) is being wound down because of funding constraints. Initiated in 1975, this was to be a cost-shared program with Canadian industry to reduce the capital and operating jobs of firms willing to try new pollution abatement technology.

In the United States, the federal government increases its maximum financial assistance for treatment works from 75% to 85% if innovative technology is applied. This has the end effect of proving out new equipment or processes for more widespread application by states or industrial users, speeding up the commercialization of new equipment, and presumably assisting national abatement programs in the long term.

The Ministry of the Environment is in a position to support new equipment and process developments which have widespread market potential through a variety of means, including the use of its experimental facilities and various financial measures. This report does not attempt to recommend specific action. However,

RECOMMENDATION

THAT THE MINISTRY OF THE ENVIRONMENT REVISE ITS ROLE TO FURTHER SUPPORT THE ACCEPTANCE OF NEW CANADIAN POLLUTION CONTROL EQUIPMENT AND PROCESSES FOR WATER AND WASTEWATER TREATMENT.

CONCLUSION

In terms of significance to the viability of the pollution control equipment manufacturing industry, Ministry legislation, regulation and enforcement may have an even more important effect than the overall state of the economy.

More cooperation between the Government and the equipment manufacturers would aid social goals as well as the environmental goals of the Province. Possibly this report can be the start of a dialogue between the two.

APPENDICES

SECTION 8 OF PART II OF THE ENVIRONMENTAL PROTECTION ACT

(1) No person shall,

(a) construct, alter, extend or replace any plant structure, equipment, apparatus, mechanism or thing that may emit or discharge or from which may be emitted or discharged a contaminant into any part of the natural environment other than water; or

(b) alter a process or rate of production with the result that a contaminant may be emitted or discharged into any part of the natural environment other than water or the rate or manner of emission or discharge of a contaminant into any part of the natural environment other than water may be altered,

unless he has first obtained a certificate of approval issued by the Director for the methods or devices or both to be employed to control or prevent the emission or discharge of any contaminant into any part of the natural environment other than water. 1972, c. 106, s. 2, part; 1974, c. 20, s. 4.

(2) The Director may require an applicant for a certificate of approval under subsection 1 to submit any plans, specifications and other information and to carry out and report on any tests or experiments relating to the plant, structure, equipment, apparatus, mechanism or thing or to the methods and devices to be employed to control or prevent the emission or discharge of any contaminant into any part of the natural environment other than water and, subject to subsection 4, the Director may issue a certificate of approval.

(3) Subsection 1 does not apply to,

(a) routine maintenance carried out on any plant, structure, equipment, apparatus, mechanism or thing;

(b) equipment for the combustion of fuel, other than waste incinerators, in buildings or structures designed for the housing of not more than three families;

(c) any equipment, apparatus, mechanism or thing in or used in connection with a building or structure designed for the housing of not more than three families where such equipment, apparatus, mechanism or thing may produce sound or vibration;

(d) any plant, structure, equipment, apparatus, mechanism or thing that may be a source of contaminant of a class exempted therefrom by the regulations;

(e) any plant, structure, equipment, apparatus, mechanism or thing used in agriculture;

(f) any motor or motor vehicle that is subject to the provisions of Part III.

(4) The Director may refuse to issue a certificate of approval or may issue a certificate of approval on such terms and conditions or alter any terms and conditions in a certificate of approval as he considers necessary,

(a) to ensure that any construction, alteration, extension or replacement that is referred to in clause (a) of subsection 1 or that any alteration of a process or rate of production that is referred to in clause (b) of subsection 1, or the methods or devices or both employed to control or prevent the emission or discharge of any contaminant into any part of the natural environment other than water, will result in compliance with this Act and the regulations and any order or approval thereunder;

(b) on probable grounds, to prevent or alleviate a nuisance, a hazard to the health or safety of any person or impairment of the quality of a natural environment for any use that can be made of it. 1972, c. 106, s. 2, part.

Ministry of the Environment

Ontario

APPENDIX 2

FOR OFFICE USE

Application No.
Date

Application for a Certificate of Approval (Air)

In accordance with Section 8, The Environmental Protection Act, 1971, the undersigned as ( ) owner, or ( ) agent applies for approval of plans and specifications, submitted herewith in duplicate, for:

- ☐ the construction of a plant, factory, structure or manufacturing process as referred to in Section 8(1) (a) of the Act
- ☐ the installation of emission control equipment as referred to in Section 8(1) (a)
- ☐ a change of process or increased production of a plant, referred to in Section 8(1) (b)

consisting of: (brief description of proposal as related to this application)

_____

_____

_____

_____

1. Owner of the plant or emission control equipment

Name	Postal Address	Telephone

2. Location of plant or emission control equipment

Street & No. or Lot & Concession No.	City, Town or Township	County

3. Plans and specifications prepared by:

Name	Postal Address	Telephone

4. Description of manufacturing or production process with emphasis on sources of emissions to be exhausted from the plant.

_____

_____

_____

Additional and supporting information enclosed

Yes ☐ No ☐

5. **Production Data**

List principal materials used and products produced in the plant or part of the plant under consideration, giving volume, weight, or quantity per day, week or other production period.

Raw Materials

Products

Current Production Level	Future Production Level and Date

6. **Industrial Operating Schedule**

hours per day	days per week	weeks per year	indicate shift periods

7. CONTROL EQUIPMENT FOR WHICH APPROVAL IS REQUESTED

	No. of Units		No. of Units		No. of Units
Baghouse		Scrubber		Paint Spray Booth & Controls	
Cyclone		Electrostatic Precipitator		Other	

Pertinent Design Information, including manufacturer's specifications and proposed operating data if available.

Additional information enclosed ☐ Yes ☐ No

8. INFORMATION AND DRAWINGS TO BE SUBMITTED WITH APPLICATION

Attached (check √)

(a) A process-flow diagram and floor plan showing material flow and unit operations, including a material balance, and heat balance where applicable. The points of emission and amounts involved for each contaminant must be identified on the process-flow diagram. In addition the handling and storage of both raw material and finished products must be shown as well as the disposition of waste products. ☐

(b) A drawing indicating the location of proposed emission control equipment and all stack or exhausters venting to atmosphere including dimensions of buildings. ☐

(c) A plot, roof, and elevation plan, drawn to scale if possible and showing emission points and distances to critical receptors (air intakes, openable windows, doors, etc.) on the attached building and other on-property buildings, must be included. The distance from the points of emission to all property lines must be indicated. ☐

(d) A plan showing the relation of the points of emission to off-property structures in the immediate neighbourhood must be supplied. This should include distances from the points of emission to the structure in question and the heights of the structure relative to the ground level elevation at the points of emission. The zoning designation and land use in the neighbourhood should also be indicated on the plan. "Immediate neighbourhood" means that area around the installation likely to be affected by air borne emissions from the installation. ☐

(e) Information data sheets on the emission control equipment or plant manufacturing facilities as required by the Ministry for assessment purposes must be submitted. ☐

Note: Similar information for existing processes, plants, etc., located on the same property may be required if they have not previously been submitted to the Ministry.

9. **Receptors on Owner's Property** ☐

Distance from the emission point to the nearest critical receptor (air intake, openable window, door, etc.)

_____ metres (m)

10. **Surrounding Land Use Defined as Immediate Neighbourhood**

Distance from stack to nearest building (meters (m))	Height of nearest building (m)	

Distance from stack to nearest building higher than the stack (m)	Height of this building (m)

What is the adjacent land use designation?

Commercial ☐ Residential ☐ Industrial ☐ Agricultural ☐

Will an amendment to an official plan or zoning by-law be required? Yes ☐ No ☐

11. **General data to be supplied for each stack, vent, or exhauster**

Height of stack above roof metres (m)	above grade (m)	Stack exit diameter (m)	Construction material of stack

Volume of exhaust gases standard m^3/sec.	Exit temperature of exhaust gases °C	Contaminants to be discharged in exhaust

If particulate is involved the particle size distribution is:

Rate of contaminant discharge

Additional information enclosed Yes ☐ No ☐

12. List chemicals or any other material used, produced, stored, or otherwise present on plant property which could, by any means, discharge toxic contaminants or potentially hazardous materials directly or indirectly to the atmosphere.

Name of Toxic Chemical	Use of Chemical in Plant	Amount Lost to Atmosphere

Additional information enclosed Yes ☐ No ☐

13. **Stock Piles**

Stock piles of raw materials, products, or any other material stored in the open that could give rise to emissions, should be identified and methods of controlling dust emissions, if applicable, such as spraying etc., should be indicated.

Additional information enclosed Yes ☐ No ☐

14. **Noise**

What measures are to be undertaken as a result of the operation of the proposed manufacturing plant or emission control facility to maintain noise at satisfactory levels.

Additional information enclosed Yes ☐ No ☐ Not applicable ☐

15. **Other Wastes**

Will this installation result in the production of liquid or solid wastes? Yes ☐ No ☐

If yes, describe nature and quantity and how they are to be handled.

16. **Estimate of Capital Cost**

Cost of Manufacturing Plant Process	$	Cost of Control Equipment	$
Labour	$	Labour	$
Other	$	Other	$
Total	$	Total	$

Estimated annual operating cost for control equipment $ _____

I hereby declare that the plans, specifications and information stated in this application are true and complete in every respect.

Name of Applicant _____
(Please print)

Official Title _____ Company _____

Postal Address _____

_____ Telephone No. _____

Signature _____ Date _____

Note: If signed by an agent, written authorization duly executed by the proper officers of the owner must accompany this application.

CHECK LIST TO BE USED BY APPLICANT IN ASSEMBLING COMPLETED APPLICATION.

(1) Process-flow diagrams and floor plans including material and heat balances where applicable. ☐

(2) Plot, roof, and elevation plans showing property lines, any emission points, and critical receptors related to on-property structures. ☐

(3) Plans showing the relation of the points of emission to off-property structures in the immediate neighbourhood. ☐

(4) Drawings, design data, and ministry information sheets (if applicable) related to proposed emission control equipment. ☐

(5) Application duly signed. ☐

ALL INFORMATION SHOULD BE SUPPLIED IN DUPLICATE: One copy should be mailed to the local district office of the Ministry whose address is:

and the second copy should be mailed to:

Environmental Approvals Branch,
Ministry of the Environment,
135 St. Clair Avenue, West,
Toronto, Ontario M4V 1P5

Approval of
application recommended on _____ 19_____ Examiner _____

ESTIMATION OF MISSING SPECIFICATIONS

The following figures are the average equipment sizes (CFM), equipment costs and installation costs by equipment type, calculated from 1977 applications for certificates of approval with complete data. These averages were used to complete all missing 1974, 1975, 1976 and 1977 data, with the exception of several cases noted below.

Where statistically significant differences could be found between sectors, sector breakdowns are given. Where partial specifications were available for a particular item, data was completed by assuming a linear relationship between size, equipment value and installation cost.

	Average Size CFM	Equipment Value	Installation Cost
Baghouses:			
Mining and metal processing sector	13,000	$ 46,800	$ 23,400
Chemical sector	30,000	120,000	67,000
Food sector *	5,000	12,500	6,600
Pulp and Paper sector Miscellaneous Industries	15,000	37,500	22,100
Scrubbers:			
All sectors	20,000	64,000	38,400
Cyclones:			
All sectors excluding Food	31,000	13,000	5,500
Food sector *	7,000	11,900	3,200
Electrostatic Precipitators:			
All sectors		(insufficient data)	

No attempt was made to estimate missing electrostatic precipitators statistics prior to 1977 since total demand was small.

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* *Excluding grain elevator applications at Thunder Bay.*

The August, 1978 issue of the Journal of the Air Pollution Control Association contains an article "Capital and Operating Costs of Selected Air Pollution Control Systems -1"(13) which provides (American) cost curves for various equipment as of December, 1977 estimated to be accurate to ± 20% . The strong dependence of equipment cost on variations in technical specification is in evidence from the five sets of baghouse cost curves taken from this article which are shown on the following page. They are provided here only to show the range of requirements that must be considered for any particular application.

On the assumption that the "average" figures used in this report represent standard equipment installations, the costs used are well within the expected range of costs reported in (13):

Baghouses:

For Miscellaneous Industries, assume an air-to-cloth ratio of A/C = 5.0. The "theoretical" prices for various basic types of 15,000 cfm baghouses (less bags) are:

- continuous pressure, mechanical shaker $ 19,800
- continuous pressure, pulse jet $ 33,900
- continuous pressure, reverse air $ 36,900

The price used in this report (less bags) would be about $34,000.

For the Mining and Metal Processing Sector, A/C could be as low as 2.0, and in addition some adjustment is necessary for hot operating environments.

In the Chemical Sector, the higher costs are probably due to the need for corrosion resistance and special fabrics.

In the Food Sector, A/C is probably as high as 7 or 8.

Scrubbers:

The "theoretical" price formula $P = k\ (7117 + 408V - .85V^2)$ for a 20,000 cfm scrubber generates costs compatible with this report's $64,000 figure of $k \simeq 4.1$.

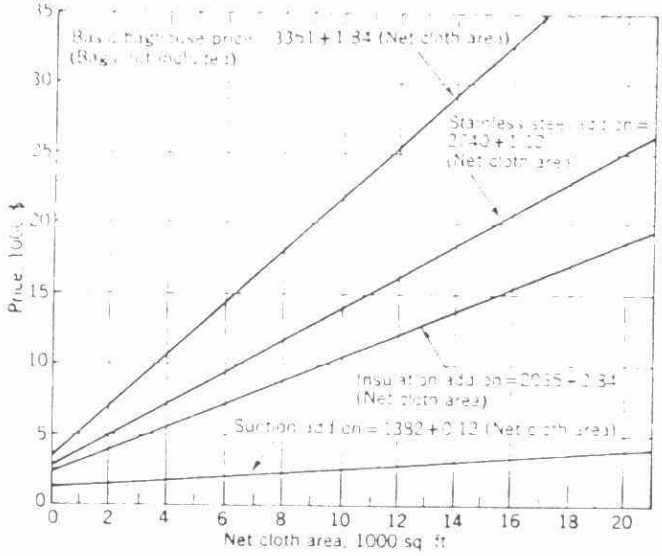
The range $.5 \leq k \leq 7.4$ is possible.

Electrostatic Precipitators:

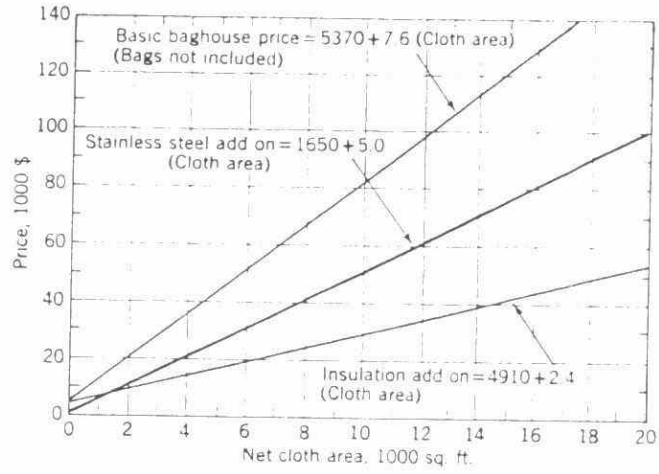
The basic formula for an uninsultated precipitator is $P = 86{,}400 + 2.95A$ where A is the net plate area in square feet.

All of the actual costs reported for 1977 gave much lower prices, and this formula was not used. The few installations of precipitators during 1974, 1975 and 1976 where cost information was not available are not included in any analysis.

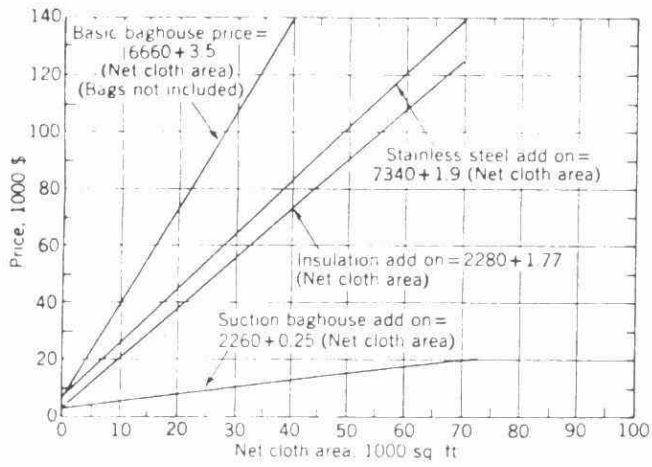
BAGHOUSE THEORETICAL COST CURVES


Price, 1000 $
Net cloth area, 1000 sq. ft.
Stainless steel add on = 2240 + 1.02 (Net cloth area)
Insulation add on = 2035 + 2.84 (Net cloth area)
Suction add on = 1382 + 0.12 (Net cloth area)

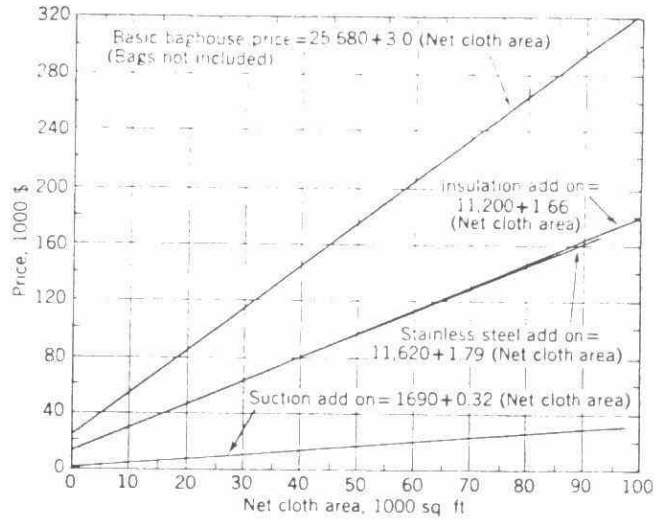
Intermittent, pressure, mechanical shaker baghouse prices vs. net cloth area. Data valid for December 1977.


Basic baghouse price = 5370 + 7.6 (Cloth area)
(Bags not included)
Stainless steel add on = 1650 + 5.0 (Cloth area)
Insulation add on = 4910 + 2.4 (Cloth area)
Price, 1000 $
Net cloth area, 1000 sq. ft.

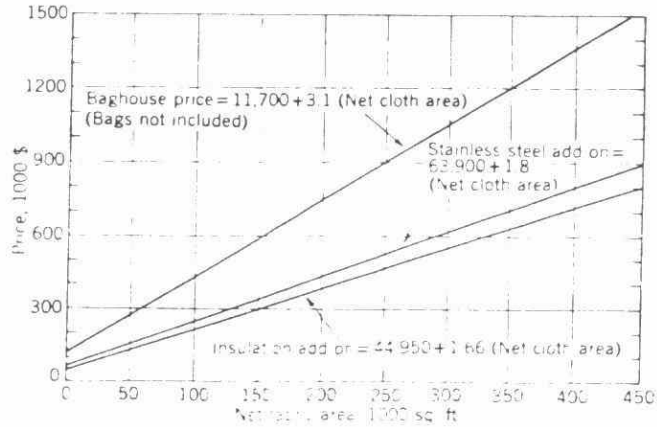
Continuous, suction or pressure, pulse jet baghouse prices vs. net cloth area. Data valid for December 1977.


Basic baghouse price = 16660 + 3.5 (Net cloth area)
(Bags not included)
Stainless steel add on = 7340 + 1.9 (Net cloth area)
Insulation add on = 2280 + 1.77 (Net cloth area)
Suction baghouse add on = 2260 + 0.25 (Net cloth area)
Price, 1000 $
Net cloth area, 1000 sq. ft.

Continuous, pressure, mechanical shaker baghouse prices vs. net cloth area. Data valid for December 1977.


Basic baghouse price = 25,680 + 3.0 (Net cloth area)
(Bags not included)
Insulation add on = 11,200 + 1.66 (Net cloth area)
Stainless steel add on = 11,620 + 1.79 (Net cloth area)
Suction add on = 1690 + 0.32 (Net cloth area)
Price, 1000 $
Net cloth area, 1000 sq. ft.

Continuous, pressure, reverse air baghouse prices vs. net cloth area. Data valid for December 1977.


Baghouse price = 11,700 + 3.1 (Net cloth area)
(Bags not included)
Stainless steel add on = 63,900 + 1.8 (Net cloth area)
Insulation add on = 44,950 + 1.66 (Net cloth area)
Price, 1000 $
Net cloth area, 1000 sq. ft.

Custom, pressure or suction, baghouse prices vs. net cloth area. Data valid for December 1977.

APPENDIX 4

SOUTHAM CONSTRUCTION COST INDEX

1971 = 100

Annual Averages

Composite Ontario Series

1971	100.0	
1972	106.3	
1973	125.1	
1974	145.0	
1975	164.0	
1976	179.7	
1977	193.2	
.....		
1978	208.6	(Estimated)

IMPORTED EQUIPMENT -- 1977

No.	Company
Baghouses	
4	The Torit Division of Donaldson Co., Inc., St. Paul, Minn.
3	Pangborn Corp., Hagerstown, Maryland
3	American Precision Industries, Buffalo, N.Y. and Greensville, Tenn.
3	W. W. Sly Manufacturing Co., Cleveland, Ohio
2	Strayer Co., Erie Penn.
2	Buell Division of Envirotech Corp., Lebanon, Penn.
2	ILMEG System, Behmbrogatan, Nykoping, Sweden
1	AGET Manufacturing Co., Adrian Mich.
1	Dust Control Inc., Greensboro, N. Carolina
1	Maquinaria Anivi, S.A., Balbao, Spain
22	
Scrubbers	
10	Schutte and Koerting Co., Cornwall Heights, Penn.
1	Duall Industries, Owosso, Mich.
1	Ultrasonics Inc., Plainsview, N.Y.
1	Emtrol Ltd., Great Neck, N.Y.
1	Midland Ross Corp., Owosso, Mich.
1	Barber-Greene Co., Aurora, Ill.
1	Norton Chemical Process Products, Akron, Ohio
1	Cedarapids Manufacturing Co., Cedar Rapids, Iowa
1	Heil Process Equipment Co., Cleveland, Ohio
18	
Electrostatic Precipitators	
6	Plioton Corp. of America, Niagara Falls, N.Y.
1	Interrad Corp., Stamford, Conn.
1	Beltan Associates Inc., Brooklyn, N.Y.
1	United McGill Corp., Columbus, Ohio
2	United Air Specialists, Location unknown
11	

No.	Company
Cyclones	
16	Emtrol Ltd., Great Neck, N.Y.
12	Barber-Greene Co., Aurora, Ill.
9	Aget Manufacturing Co., Adrian, Mich.
6	Kice Metal Products Co., Wichita, Kansas
3	The Torit Division of Donaldsons Co., Inc., St. Paul, Minn.
2	ILMEG System, Behmbrogatan, Nykoping, Sweden
2	United McGill Corp., Columbus, Ohio
1	Aerodyne Development Corp., Cleveland, Ohio
1	Heil Processing Equipment Co., Cleveland, Ohio
1	Cedarapids Manufacturing Co., Cedar Rapids, Iowa
1	W. W. Sly Manufacturing Co., Cleveland, Ohio
4	Location unknown
58	

APPENDIX 6

PRIMARY AIR POLLUTION CONTROL

EQUIPMENT, SUPPLIES AND SERVICES

MANUFACTURERS AND AGENTS IN ONTARIO

1. BARBER-GREENE CANADA LTD.

Location:	Milton
Parent:	Barber-Greene Co., Aurora, Ill.
Products:	Air pollution control equipment for the asphalt industry (100% imported)
Employment:	5

2. DUCON-MIKROPUL CANADA LTD.

Location:	Bramalea
Parent:	U.S. Filter Corp., New York, N.Y. (Micropul Division of U.S. Filter has a plant in Montreal)
Products:	Baghouses, scrubbers, precipitators
Employment:	30

3. N.R. MURPHY LTD.

Location:	Cambridge
Subsidiary:	Murphy Rogers Inc., Huntington Park, Calif.
Products:	Dust collection systems
Employment:	30

4. RESEARCH-COTTRELL CANADA LTD.

Location:	Toronto
Parent:	Research-Cottrell Incorp., Bound Brook, N.J.
Products:	Dust collectors, precipitators, scrubbers, baghouses, SO_2 removal
Employment:	3

5. GRANDVIEW INDUSTRIES LTD.

Location:	Rexdale
Parent:	Noranda Mines Ltd., Toronto
Products:	Mist eliminators
Employment:	10

6. PENSTEEL INDUSTRIES LTD.

Location:	St. Catharines
Associated Co.:	KMW Products Ltd., Fort Erie, Pensteel KMW Inc., Batavia, N.Y.
Divisions:	Wilson Engineering and Fabricating Div., Winona
Products:	Baghouses
Employment:	1

7. PORRITTS AND SPENCER (CANADA) LTD.

Location:	Hamilton
Parent:	SCAPA Group Ltd., Blackburn, England
Products:	Filter fabrics
Employment:	65

8. CANADIAN BLOWER AND FORGE CO. LTD.

Location:	Kitchener
Parent:	Buffalo Forge Co., Buffalo
Subsidiary:	Canada Pumps Ltd., Kitchener
Products:	Blowers, fans, dust collection equipment
Employment:	180

9. PRECISIONEERING LTD.

Location:	Scarborough
Products:	Fans, fume scrubbers, mist eliminators, custom equipment
Employment:	55

10. CEILCOTE CANADA LTD.

Location:	Rexdale
Parent:	The Ceilcote Co., Berea, Ohio
Products:	Fittings, fume scrubbers, fans, air pollution control equipment
Employment:	47

11. DEVILBISS (CANADA) LTD.

Location:	Barrie
Parent:	Devilbiss Corp., U.S.
Products:	Dust collectors, spray booths
Employment:	40

12. BINKS MFG. CO. OF CANADA LTD.

Location:	Toronto
Parent:	Binks Mfg., Co., Franklin Par, Illinois
Products:	Compressors, paint spray booths
Employment:	27

13. MAC DONALDS STEEL LTD.

Location:	Cambridge
Products:	Air reclaimers, cyclone separators, custom metal fabrication
Employment:	35

14. CEA SIMON-DAY LTD.

Location:	Thunder Bay, Winnipeg and Toronto
Parent:	Cumbustion Equipment and Assoc. Inc., New York
Products:	Dust control systems
Employment:	40

15. WHEELABRATOR CORP. OF CANADA LTD.

Location:	Oakville (Moving to Milton where textile mill is located)
Parent:	Wheelabrator-Frye, Inc., N.Y.
Products:	Air pollution control equipment, research and development in filter bags
Employment:	207

16. HOFFMAN INDUSTRIES OF CANADA LTD.

Location:	Toronto
Parent:	Hoffman Air and Filtration Div., Clarkson Industries, New York, N.Y.
Products:	Centrifugal blowers, filtration equipment
Employment:	5

17. TOTAL-AIR SYSTEMS LTD.

Location:	Burlington
Products:	Air filters, dust collectors
Employment:	15

18. AER-O-FLOW MFG. LTD.

Location:	Hamilton
Products:	Scrubbers
Employment:	2

19. CARBORUNDUM ENVIRONMENTAL SYSTEMS CANADA LTD.

Location:	Mississauga
Parent:	Carborundum Co., Niagara Falls, N.Y.
Products:	Baghouses
Employment	30 + subcontracting

20. BALTIMORE AIRCOIL OF CANADA

Location:	Georgetown
Parent:	Baltimore Aircoil Co. Incor., Baltimore, Maryland
Products:	Evaporative condensors
Employment:	15

21. GATX-FULLER

Location:	Scarborough
Head Office:	Fuller Co., Catascuiqua, Pa.
Products:	Compressors, blowers, dust collectors, fume control
Employment:	18

22. FARR COMPANY LTD.

Location:	Toronto
Parent:	Farr Inc., Calif.
Products:	Filters
Employment:	34

23. MARLEY CANADIAN LTD.

Location:	Toronto
Products:	Cooling towers
Employment:	30 + subcontracting

24. McINNIS EQUIPMENT LTD.

Location:	Windsor
Products:	Pollution control equipment for foundries
Employment:	7

25. CAN-ENG MFG. LTD.

Location:	Niagara Falls
Parent:	Can-Eng. Holdings Ltd., Niagara Falls
Subsidiaries:	Steffler Metal Products, Kitchener, Poly-Thane Industries Ltd., Niagara Falls
Products:	Dry collectors, wet scrubbers, fume incinerators, electrostatic precipitators
Employment:	5

26. FILTERFAB INCORP.

Location:	St. Catharines
Parent:	English
Products:	Filter bags
Employment:	28

27. ABART ENGINEERING
    Location:
    Products: Air pollution control equipment
    Employment: 2

28. DACE INDUSTRIES LTD.
    Location: Windsor
    Products: Air pollution equipment
    Employment: 5

29. ENDUR
    Location:
    Products: Baghouse maintenance and repair
    Employment: 12

30. MC CARTHY AND ROBINSON
    Location: Scarborough
    Products: Agents for Sly and Dynaclone
    Employment: 5

31. NORTECH CONTROL EQUIPMENT
    Location:
    Products:
    Employment: 4

32. PHILIPS ELECTRONICS
    Location:
    Products: Instrumentation
    Employment: 2

33. TORIT
    Location:
    Parent: Torit Div. of Donaldson Inc., St. Paul, Minn.
    Products: Small baghouses, filters
    Employment: 2

34. UNITED AIR SPECIALISTS
    Location: Toronto
    Products: precipitators
    Employment: 5

35. KSF CHEMICAL PROCESSES LTD.

Location:	Cambridge
Products:	Pollution control equipment
Employment:	12

36. NATIONAL GENERAL FILTER PRODUCTS LTD.

Location:	Brampton
Products:	Air filters
Employment:	10

37. AIR CORRECTION DIVISION - UOP

Location:	
Products:	
Employment:	10 + subcontrating

38. BLAST-TECH LIMITED

Location:	Oakville
Products:	Baghouse maintenance, repairs
Employment:	9

39. INDUSTRIAL FILTER FABRICS LTD.

Location:	Hamilton
Products:	Filter bags
Employment:	9

40. DRESSOR INDUSTRIAL PRODUCTS LTD.

Location:	Mississauga
Products:	Electrostatic precipitators
Employment:	2 + subcontracting

41. TECHNEQUIP. LTD.

Location:	Weston
Products:	Valves, flotation cells, cyclones, pumps, gas scrubbers
Employment:	24

42. UNIVERSAL FILTER MEDIA

Location:	Weston
Parent:	The National Filter Media Corp., New Haven, Conn.
Products:	Filter fabrics
Employment:	29

Total Environmental Equipment Employment:	1,106

CAPITAL EXPENDITURES ON MACHINERY AND EQUIPMENT -- ONTARIO

($ millions)

CLASSIFICATION	1973	1974	1975	1976	1977	1978 *
MINING & METAL PROCESSING	90.5	373.7	475.4	428.0	483.9	460.7
CHEMICAL	217.8	217.4	440.4	549.7	546.2	423.0
FOOD	157.7	129.7	124.1	132.6	151.6	175.7
PULP & PAPER	178.0	128.7	169.5	226.2	199.2	138.2
MISCELLANEOUS	1,929.0	666.0	715.8	651.3	734.0	863.6
TOTAL ONTARIO	2,573.0	1,515.5	1,925.2	1,987.8	2,114.9	2,061.2

CAPITAL EXPENDITURES ON MACHINERY AND EQUIPMENT -- CANADA

($ millions)

	1973	1974	1975	1976	1977	1978 *
MINING & METAL PROCESSING	732.9	998.6	1,258.3	1,580.1	1,692.3	1,395.2
CHEMICAL	281.7	488.9	712.7	849.5	892.3	935.2
FOOD	257.8	297.4	296.5	309.6	353.4	392.7
PULP & PAPER	313.0	433.8	467.2	560.1	609.8	634.5
MISCELLANEOUS	1,501.2	1,754.8	1,862.1	1,810.3	1,945.1	2,135.3
TOTAL CANADA	3,086.6	3,973.5	4,596.8	5,109.6	5,492.9	5,492.9

* *Preliminary estimates as of April, 1978.*

EXAMPLES OF THE SIGNIFICANCE OF IMPORTS

		IMPORTS		($ thousands)		
	COMMODITY CLASSIFICATION	1973	1974	1975	1976	1977
703-44	Flow level measuring and control instruments and parts	9,303	10,971	12,757	14,341	16,780
703-75	Pressure measuring and control instruments	4,717	7,768	6,205	10,581	12,937
703-79	Measuring and control instrumentation, n.e.s.	3,636	5,265	5,757	5,902	7,872
703-95	Parts of measuring and control instruments, n.e.s.	30,681	29,723	31,839	31,324	35,715
684-26	Circuit breakers or parts	15,213	18,498	26,268	30,025	38,367
684-39	Switches and parts, n.e.s.	3,798	8,084	7,660	7,466	9,332
468-19	Valves, iron or steel, n.e.s.	31,836	45,553	72,636	60,827	65,415
468-29	Valves, Brass, n.e.s.	8,536	8,772	9,318	8,531	10,346
468-44	Valves, n.e.s.	2,461	4,446	5,684	11,217	12,670
468-48	Valve parts	13,366	14,687	22,283	23,466	26,716
508-04	Pumps, centrifugal	3,045	3,730	6,106	7,789	8,448
508-30	Pumps, power, n.e.s.	18,208	19,890	25,333	25,947	29,188
508-79	Parts of power pumps	20,738	26,502	32,783	32,370	38,742
508-95	Pumps and parts, n.e.s.	3,992	6,005	8,443	10,551	13,730
509-79	Dust collection and related equipment and parts	4,946	7,283	8,655	9,579	9,368
509-85	Industrial filtering machinery, filters and parts	5,481	6,988	7,101	8,267	11,462

		EXPORTS		($ thousands)		
509-99	General purpose industrial machinery and parts, n.e.s.	6,665	15,357	14,865	10,821	15,228
508-89	Pumps and pumping systems	* 12,797	14,228	10,781	13,449	14,534
508-98	Parts of pumps and pumping systems			10,591	14,043	17,385

* *Classification 508-99 (Pumps, pumping systems and parts) is given for 1973 and 1974. Classifications 508-89 and 508-98 could not be determined.*

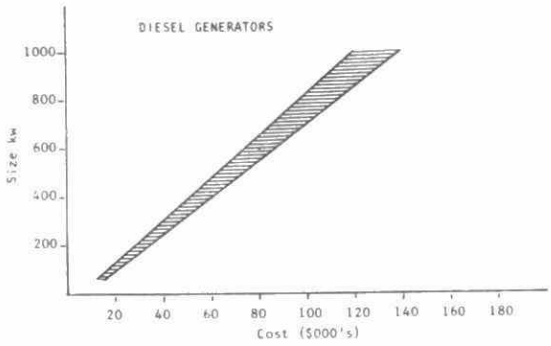
ESTIMATED CAPITAL EXPENDITURES FOR INDUSTRIAL WASTEWATER TREATMENT WORKS

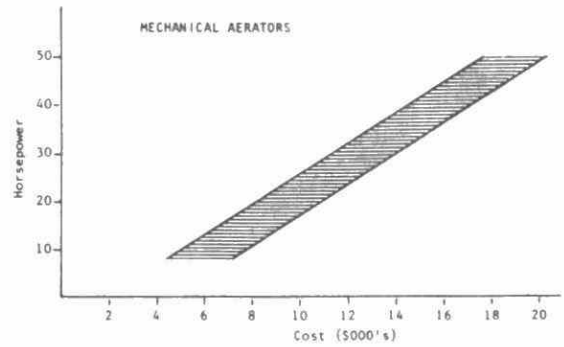
1967 - 1977

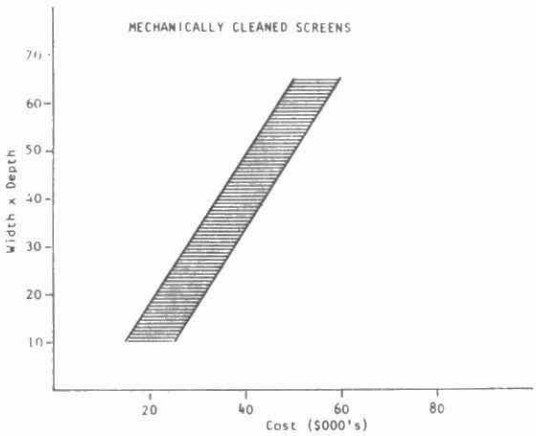
($ thousands)

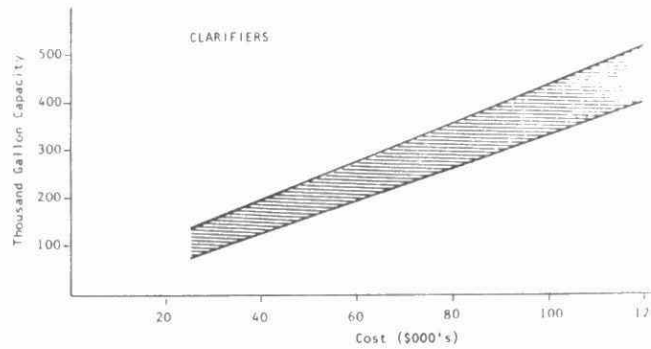
	Industry Classification	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
1.	Mining & Metal Processing	1,469	173	531	25	12,983	2,230	3,804	5,750	4,849	5,182	350
	Metal Working Plating & Finishing	-	-	-	673	528	88	101	55	256	937	43
	Mining & Metallurgical	2,064	1,400	958	1,872	13,301	3,071	37,101	2,144	5,812	253	2,386
2.	Petroleum & Petrochmeicals	813	-	-	1,177	2,084	4,671	3,489	5,373	6,025	24,577	10,742
	Chemicals	1,112	1,161	2,276	2,059	3,837	3,861	867	2,013	11,941	1,665	9,010
3.	Food	219	1,011	1,960	716	824	1,808	41	20	223	646	980
4.	Pulp & Paper	778	1,006	5,686	6,502	6,519	13,372	5,323	5,952	704	4,529	16,537
5.	Miscellaneous Manufacturing	4,372	477	3,397	2,013	633	2,662	1,267	32	580	18	444
	Service Industry	-	72	273	10,315	2,043	431	559	960	693	6,802	-
	Tanning & Rendering	-	-	-	-	152	-	-	253	53	-	-
	Textiles	-	-	-	73	-	-	-	-	-	-	-
	TOTAL	10,827	5,300	15,081	25,425	42,904	32,194	52,552	22,552	31,136	44,609	40,092
1.	MINING & METAL PROCESSING	3,533	1,573	1,489	2,570	26,812	5,389	41,006	7,949	10,917	6,372	2,779
2.	CHEMICALS	1,925	1,161	2,276	3,236	5,921	8,532	4,356	7,386	17,966	26,242	19,752
3.	FOOD	219	1,011	1,960	716	824	1,808	41	20	223	646	980
4.	PULP & PAPER	778	1,006	5,686	6,502	6,519	13,372	5,323	5,952	704	4,529	16,537
5.	MISCELLANEOUS	4,372	549	3,670	12,401	2,828	3,093	1,826	1,245	1,326	6,820	444
	TOTAL	10,827	5,300	15,801	25,425	42,904	32,194	52,552	22,552	31,136	44,609	40,092

COST CURVES FOR COMMON EQUIPMENT USED IN WATER AND SEWAGE TREATMENT FACILITIES









SLUDGE HANDLING DEVICES ($000's)

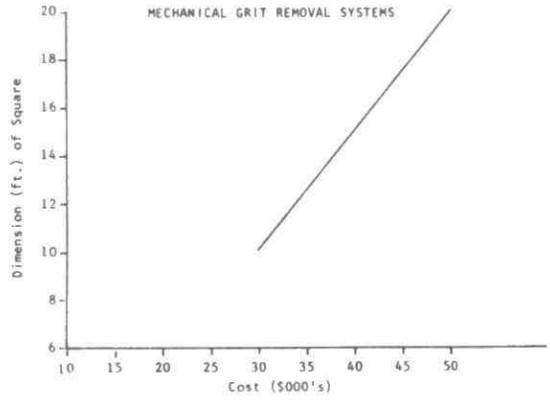
No price patterns apparent.

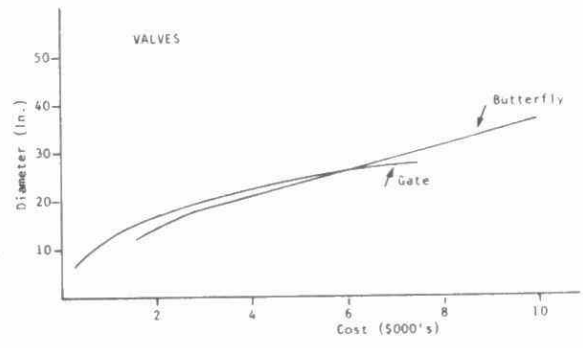
COMMINUTION DEVICES ($000's)

No price patterns apparent.
Typically cost $5.0 - $10.0

CHLORINATION SYSTEMS ($000's)

Typically cost $5.0 - $10.0





SUPPLIERS OF WATER AND SEWAGE TREATMENT EQUIPMENT IN PROVINCIAL PROJECTS, LISTED IN ORDER OF IDENTIFIED VOLUME OF SALES

(1) PUMPS: (Raw sewage, lift, sludge and pumping stations)

Worthington
Chicago Pump
Flygt
Smart-Turner-Hayward
Fairbanks-Morse
Crane
Canada Pump
Carter
Allis-Chalmers
Smith & Loveless
Weinman
Midland
Babcock-Wilcox
Pacific
Robert Morse
A.S. Leitch
Meyers

(2) COMMUNITION:

Chicago Pump
Worthington
Cord Engineering
Condox
Jones & Atwood
Heligear
Ecodyne
Napanee Industries
Procor
Infilco
Smith & Loveless

(3) MECHANICAL GRIT REMOVAL SYSTEMS:

Dorr-Oliver
Link Belt
Rex Chainbelt
Chicago Pump
Eimco

(4) AIR SUPPLY:

Sutorbilt
Rocks-Connersville
Hoffman
Broun Boveri
Spenser Turbo
Chicago Pump
Cord
James Houden
Gatx
Utility Technology
Flexofuser

(5) AERATION EQUIPMENT:

Asdor

(6) SLUDGE DIGESTORS:

Dorr-Oliver
Eimco
PFT
Carter

(7) CHLORINATION EQUIPMENT:

Wallace & Tiernan
Fischer & Porter
BIF
Advance

(8) SEDIMENTATION TANKS:

Dorr-Oliver
Walker Process
Falk
Rex Linkbelt
Infilco
Eimco
Smith & Loveless
United Steel Corp.
Spiraflow
Ames-Crosta

PRIMARY WATER POLLUTION CONTROL EQUIPMENT/CHEMICAL MANUFACTURERS AND AGENTS IN ONTARIO

1. ALBANY PUMP CO.
   - Location: Toronto
   - Products: Pumps, chlorinators
   - Employment: 15

2. ALCHEM LTD.
   - Location: Burlington
   - Products: Clarification, waste pollution control
   - Employment: 10

3. ALLIED COLLOIDS (CANADA) LTD.
   - Location: Rexdale
   - Parent: Allied Colloids Inc., Ridgewood, N.J.
   - Products: Flocculants
   - Employment: 2

4. ASDOR
   - Location: Downsview
   - Products: Sewage disposal equipment
   - Employment: 11

5. ANTHRAFILTER MEDIA AND COAL LTD.
   - Location: Hamilton
   - Products: Filter media
   - Employment: 2

6. BIF - (BASIC IN-FLOW)
   - Location: Rexdale
   - Parent: U.S. General Signal
   - Products: Valves
   - Employment: 13

7. CALGON CANADA
   - Location: Bramalea
   - Parent: Calgon
   - Products: Water treatment chemicals
   - Employment: 10

8. CRANE CANADA - COCHRANE ENVIRONMENTAL SYSTEMS DIVISION

Location:	Cornwall
Products:	Filtration equipment
Employment:	38

9. GENERAL FILTRATION AND ENGINEERING

Location:	Scarborough
Products:	Filtration equipment
Employment:	7

10. ECODYNE - VARIOUS DIVISIONS

Location:	Oakville
Parent:	U.S.
Products:	Water treatment plants, sewage treatment equipment and lift stations, chemical feed pumps
Employment:	60

11. GREEY MIXING EQUIPMENT

Location:	Toronto
Parent:	U.S.
Products:	Mechanical aerators, wastewater treatment
Employment:	33

12. KOMLINE-SANDERSON

Location:	Brampton
Parent:	Komline-Sanderson, Engineering Corp., Peapack, N.J.
Products:	Sewage disposal machinery, clarifiers, filters, filtration equipment, pollution controls, pumps
Employment:	17

13. MICROFLOC - DIVISION OF NEPTUNE METERS

Location:	Toronto
Products:	Wastewater treatment equipment and plants
Employment:	5

14. NAPIER-REID LTD.

Location:	Markham
Products:	Ontario representatives for FMC Chicago Pump Products, FMC Link Belt Products, Peabody-Wells Products, Hydrocyclone Corp. Products, AutoTrol Corp. Products, Napier-Reid Products
Employment:	6 + subcontracting

15. NUCLARUS

Location:	Toronto
Products:	Pollution control systems and equipment
Employment:	2

16. SWECO

Location:	Toronto
Products:	Waste water treatment
Employment:	2

17. OIL MOPS POLLUTION CONTROL

Location:	Mississauga
Employment:	3

18. SIMMONDS PRECISION CANADA

Location:	Mississauga
Products:	Controls gauges, instrumentation
Employment:	4

19. CONTROL AND METERING

Location:	Toronto
Products:	Dewatering equipment
Employment:	20

20. KERAMCHEMIE (CANADA) LTD.

Location:	Toronto
Products:	Pollution control equipment
Employment:	4

21. QUATIC CHEMICALS

Location:	Guelph
Products:	Water treatment chemicals and analysis
Employment:	1

22. REXNORD (CANADA) LTD.

Location:	Willowdale
Parent:	Rexnord Inc., Milwaukee, Wis.
Products:	Material handling equipment, environmental control equipment
Employment:	20

23. BRISTOL CO. OF CANADA LTD.
Location: Toronto
Products: Recording equipment
Employment: 75

24. BROUN BOVERI CANADA LTD.- KENT INSTRUMENT DIVISION
Location: Thornhill
Products: Instruments
Employment: 15

25. CANADA VALVE
Location: Kitchener
Products: Hydrants, valves, distributor for Pratt, Flexible and Cherne line of products
Employment: 175

26. DORR-OLIVER-LONG
Location: Orillia
Parent: Dorr-Oliver Inc., Stamford, Conn.
Products: Sewage treatment equipment
Employment: 130

27. FMC OF CANADA LTD.- ENVIRONMENTAL EQUIPMENT DIV.
Location: Agincourt
Products: Water and air pollution control equipment
Employment: 7

28. CORD INDUSTRIAL EQUIPMENT LTD.
Location: Toronto
Products: Pollution control equipment, comminutors, blowers, pumps, valves
Employment: 40

29. ENVIROTECH, CANADA LTD.
Location: Mississauga
Parent: Envirotech Corp., Menlo Park, Palo Alto, Calif.
Products: Water and wastewater treatment equipment
Employment: 47 + subcontracting

30. HYDRATEMP SYSTEMS LTD.
Location: Toronto
Products: Comminuting machinery, sludge and scum collectors
Employment: 9

31. FLYGT CANADA LTD.
Location: Toronto
Products: Submersible pumps
Employment: 10

32. GORMAN-RUPP OF CANADA LTD.
Location: St. Thomas
Products: Sewage pumps
Employment: 46

33. WORTHINGTON (CANADA) LTD.
Location: Brantford
Parent: Worthington, Harriston, N.J.
Products: Pumps, compressors
Employment: 60

34. PERMUTIT, OF CANADA - A DIVISION OF RITTER PFAUDLER (CANADA)
Location: Scarborough
Parent: Paramus, N.J.
Products: Water treatment equipment
Employment: 1

35. SMART-TURNER-HAYWARD LTD.
Location: Hamilton
Products: Chemical and sewage pumps
Employment: 12

36. GRAY ENGINEERING
Location: Toronto
Products: Filters, pumps, valves
Employment: 10

37. FIELDING, CROSSMAN AND ASSOCIATES, LTD.
Location: Willowdale
Products: Venturi tubes and flumes
Employment: 3

38. WALLACE AND TIERNAN DIVISION OF PENNWALT OF CANADA
Location: Scarborough
Parent: Wallace and Tiernan, New Jersey
Products: Chemical control equipment
Employment: 17

39. CROWLE FITTINGS LTD.
Location: Mississauga
Products: Cast iron fittings for pipes
Employment: 43

40. CANBAR PRODUCTS
Location: Waterloo
Products: Tanks, lagoon linings
Employment: 25

41. DE LAVAL CO.
Location: Peterborough
Products: Vacuum pumps, storage vessels and fittings
Employment: 1

42. DE ZURIK OF CANADA LTD.
Location: Cambridge
Parent: Dezurik Corp., Sontell, Minn.
Products: Valves
Employment: 22

43. FLOW CONTROLS LTD.
Location: Scarborough
Products: Sluice gates
Employment: 5

44. FABRICATED PLASTICS
Location: Toronto
Products: Plastic pipe, valves, fittings and tanks
Employment: 32

45. FLUIDYNAMICS, DEVICES LTD.
Location: Mississauga
Products: Flow measuring systems
Employment: 15

46. FRYSTON ASSOC.
Location: Scarborough
Products: Water treatment equipment
Employment: 4

47. HINDE MFG. LTD.

Location:	Hamilton
Products:	Sewage treatment equipment, oxidation systems
Employment:	2

48. MARKLAND SPECIALTY ENGINNERING

Location:	Toronto
Products:	Sludge density meters, sludge level controllers
Employment:	3

49. PUMPS AND SOFTENERS

Location:	London
Subsidiaries:	Darling Bros., Montreal, Westco Pumps, London, Ont., Pumps & Systems (UK) Ltd., London England
Products:	Water treatment and sewage treatment
Employment:	3

50. ARTHUR S. LEITCH CO. LTD.

Location:	Midland
Products:	Pumps, pressure vessel equipment
Employment:	13

51. DIVERSEY ENVIRONMENTAL PRODUCTS

Location:	Mississauga
Products:	Chemicals for wastewater treatment
Employment:	19

52. KEYSTONE VALVE (CANADA) LTD.

Location:	Burlington
Products:	Butterfly and check valves
Employment:	10

53. MILTON ROY INDUSTRIES LTD.

Location:	Peterborough
Products:	Pumps, chemicals, feed systems, instrumentation
Employment:	8

54. PERRIN, WM. R. CO. LTD.

Location:	Ajax
Products:	Filters, filter presses
Employment:	11

55. J. WESTWAY CO. LTD.

Location:	Hamilton
Products:	Waste treatment equipment, chemical feed equipment, agitators
Employment:	4

56. F. E. MYERS AND BROS. (CANADA) LTD.

Location:	Kitchener
Products:	Meters, water treatment equipment
Employment:	13

57. ZURN INDUSTRIES INC. ENVIRO SYSTEMS DIVISION

Location:	Toronto
Products:	Wastewater treatment systems, grit collectors
Employment:	11

58. PROCHEM LTD.

Location:	Brampton
Products:	Blenders, agitators, pumps, aerators
Employment:	19

59. THE FALK CORPORATION OF CANADA LTD.

Location:	Toronto
Parent:	Fal'k Corporation, Milwaukee, Wisc.
Products:	Mechanical equipment
Employment:	10

60. NAPANEE INDUSTRIES LTD.

Location:	Napanee
Products:	Sewage treatment equipment
Employment:	5

61. CANRON LTD.

Location:	Toronto
Products:	Pipes, pipe fittings, hydrants
Employment:	200

62. FISCHER AND PORTER (CANADA) LTD.

Location:	Toronto
Parent:	Fischer and Porter Co., Warminster, Pa.
Products:	Chlorination equipment
Employment:	N/A

Total Env. Equipment and Chemicals Employment:	1,400

MACHINERY AND EQUIPMENT INCLUDED UNDER TARIFF ITEM 42700-1

Abattoir machinery
Air compressors
Air purification equipment, gaseous or vaporous
Amalgamators
Amusement rides
Automation equipment
Automobile lifts(hoists)

Bakery machinery
Ball and rod mills
Bearings, ball and roller
Bending machines, metal
Blades for roadgraders, snowplows, plowshares
Blowers
Blueprinting machines
Bookbinders' machines
Boots and shoe making and repairing machinery
Bottling machinery
Box making machines
Braiding machines
Brake equipment, hydraulic
Brakes, sheet metal work
Brewers' and maltsters' machinery
Brick and tile making machinery
Broaching machines, horizontal, vertical
Bulldozers
Burnishing machines

Cabinet makers' machinery
Cable splicers
Cages, mine shaft
Can forming machines
Canning and food packing machinery
Cars, industrial
Cars, mining
Cement making machinery
Centrifuges, ex. laboratory
Chain belting
Chain blocks and trolleys
Cheese making machinery
Chipping hammers, metal-working machinery
Chopping and grinding machinery
Clay working machinery
Cleaning and pressing equipment
Clutches, ex. automotive
Coal and ore conveyors
Coffee grinders, electric, industrial
Coin-operated amusement machines
Compressors
Concrete finishing machines
Concrete mixers
Confectionery machinery
Construction machinery
Conveyor systems
Cracker making machines
Crushing and mixing machinery
Cutting and folding machines
Cylinders, air and hydraulic
Cylinders, machine parts

Dairy machinery and equipment
Die casting machines
Diesel engines
Dishwashing machines, ex. domestic
Distillery machinery
Dollies and hand trucks
Dough mixers
Driers, dehydrators and anhydrators
Drilling machinery
Drop hammers
Dry cleaning machines
Dry kiln, lumber
Dumb waiters
Dust collecting systems

Earth boring machinery
Earth moving machinery
Electrotyping machines
Elevators, lifts
Engines, general purpose
Engines, internal combustion, ex. motor vehicle
Engines, marine
Engines, steam, ex. locomotives
Engraving machines
Escalators, passenger
Excavating, dredging and loading equipment
Exhaust and air-moving equipment
Extruding machines and equipment

Fans and blowers, industrial

Filters, dry cleaning machines
Filters, pressure and vacuum
Fire engines
Fire fighting equipment, ex. portable hand extinguishers
Fire sprinklers
Flexible-shaft machines, portable
Floor scrubbing machines
Flour machinery
Food packing and canning machinery
Food processing machinery
Forging machines, hammers, presses
Foundry machinery and equipment
Fourdrinier machines
Furnaces and ovens, industrial
Furnaces, high frequency
Furniture makers' machinery

Garment presses
Gas compressors
Gas producing apparatus
Gear-cutting machines
Gears, forged steel
Gears, power transmission
Gear-tooth grinding machines
Glass blowing and forming machinery
Glass making machinery
Grain mill machinery
Grinding and chopping machinery

Hammers, chipping and riveting
Hammers, forging machinery
Hand tools, power-driven
Hat making machinery
Hoisting and lifting machinery
Homogenizers
Honing machines
Hydraulic hose assemblies
Hydraulic jacks
Hydraulic presses

Ice cream machinery
Ice crushers
Ice making machinery
Industrial tractors (materials handling equipment)

Knitting machines

Labelling machines
Lathes
Laundry machines, commercial
Lawn mowers, power
Leather working machinery
Lift trucks
Loaders, box car and bucket
Loaders, mine car
Loaders, portable
Logging machinery
Lubricators and lubricating systems

Machine tool parts, attachments, accessories
Machine tools, power-driven
Machine tools, rebuilding
Machinery, construction and mining
Marine engineering
Meat slicers
Metal refining equipment
Metal smelting equipment
Metal-working machinery and accessories
Mills and presses, etc.
Mine hoists
Mine safety appliances
Mining cars
Mining machinery
Mixers, concrete
Mixers, ore, sand, slag, etc., ex. feed mixers
Monorail equipment, overhead
Motors, water
Motors, outboard

Oil and gas well machinery and tools
Ore precessing machinery
Oxyacetylene gas torches

Packaging machines
Packing house machinery
Paint making machinery
Paper mill machinery
Paper products machines
Paper ruling machines
Pattern makers' machinery, woodworking
Paving machines
Petroleum refinery equipment
Pharmaceutical machinery
Photoengraving machines

Piston rings, ex. automotive
Pistons, ex. automotive
Planers, surfacers, etc., wood
Pneumatic hammers and drills
Polishers, metal (machines)
Pottery making machinery
Power shovels, excavators
Power transmission machinery, mechanical
Power-driven hand tools
Presses, arbor
Presses, forming and stamping
Presses, laundry, cleaning
Printing machinery
Pulp and paper machinery
Pulp washers and thickeners
Pulverizing machinery
Pumping equipment
Pumps, power driven
Purifiers, centrifugal

Refining machinery, metal
Registers, fare, urban transport
Riveting machines
Road building machinery
Roasting machinery, coffee, peanut
Rock boring and drilling equipment
Rod forming and fabricating machines
Rollers, road
Rolling mill machinery and equipment
Rope and cordage machines
Rubber and plastic machinery

Sanding machines
Sawmill machines
Saws, woodworking machinery
Scales, railroad track
Screening machines
Semi-diesel engines
Separators, for steam, etc.
Sewing machines, industrial
Shafts, flexible
Shears, power, metal
Sheaves, mechanical transmission
Sheet metal working machines
Smelting and refining equipment
Snow plows, ex. motor vehicles
Soldering machines
Spinning machines, metal
Spraying outfits, paint, etc. ex. argricultural
Spring winding and forming machines
Slitters, metal, machines
Stackers, industrial
Stamping mill machinery
Steel mill machinery
Steel rolling machinery
Stereotyping machines
Sterilizers, bottle
Stone working machinery
Street sprinklers and sweepers (motor vehicles)
Sugar plant machinery

Tables, cutting
Tables, sludge
Tannery machines
Television antenna rotators
Textile machinery
Tobacco products machinery
Tools, drilling, oil well
Transmission equipment ex. motor vehicle
Trucks, hand, freight, baggage
Trucks, industrial
Turbine pumps
Turbines
Twisting and doubling frames
Typographic numbering machines

Universal joints, ex. motor vehicle

Veneer mill machines
Ventilating machinery and equip.
Vises, machine
Vulcanizers
Vibrating machines

Water & sewage treatment equipment
Water motors
Water well drilling machines
Welding and cutting equipment, ex. electric
Well drilling and tapping machines
Wheelbarrows
Winches
Wire forming and fabricating machines
Woodworking machines
Wrapping, bagging, cartoning and bailing machinery

NOTE

DISCOVERY OF A STRUCTURAL RELATIONSHIP BETWEEN POLLUTION CONTROL EQUIPMENT EXPENDITURES AND OVERALL CAPITAL EQUIPMENT EXPENDITURES IN INDUSTRY.

The following figures give:

(i) Cost of uninstalled water pollution control equipment and uninstalled air pollution control equipment for the five industrial sectors considered in this report, for the years 1974 to 1977.

(ii) Ontario capital expenditures on machinery and equipment (summarized from Appendix 7) for 1974 to 1977 with the most recent Statistics Canada 1978 forecast.

EXPENDITURES ON POLLUTION CONTROL EQUIPMENT

($ 000's)

		1974	1975	1976	1977	1978
MINING AND METAL PROCESSING	- Air	2,078	3,177	2,305	9,399	
	- Water	1,806	2,481	1,448	631	
	- Total	3,884	5,658	3,753	10,030	
CHEMICALS	- Air	1,583	4,102	7,749	2,874	
	- Water	1,678	4,083	5,963	4,488	
	- Total	3,261	8,185	13,712	7,362	
FOOD	- Air	533	1,628	4,613	2,852	
	- Water	5	51	147	223	
	- Total	538	1,679	4,760	3,075	
PULP AND PAPER	- Air	162	481	811	793	
	- Water	1,353	160	1,029	3,758	
	- Total	1,515	641	1,840	4,551	
MISCELLANEOUS	- Air	2,181	2,799	2,392	6,024	
	- Water	283	301	1,550	101	
	- Total	2,464	3,100	3,942	6,125	
TOTAL	- Air	6,537	12,187	17,870	21,942	
	- Water	5,125	7,076	10,137	9,201	
	- Total	11,662	19,263	28,007	31,143	?

TOTAL CAPITAL EXPENDITURES ON MACHINERY AND EQUIPMENT

($ millions)

1974	1975	1976	1977	1978
1,516	1,925	1,988	2,115	*2,061*

The 1974-77 time series of total industrial expenditures on pollution control equipment shows high correlation with the 1974-77 time series on total capital expenditures on machinery and equipment.

Correlation does not exist when expenditures on either air pollution control equipment or water pollution control equipment are considered individually, and correlation does not exist for any individual industrial sector.

Four years provides an extremely small set of data points, but if there is a true correlation, then 1978 expenditures by industry for pollution control equipment may be expected to show a drop from $31.1 million to $ 28 - 29 million, based on the Statistics Canada preliminary estimate of a drop in total capital expenditures on machinery and equipment for 1978.

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